INTERMOUNTAIN STATION
Central Reference File
No. 0.73

Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 1 April 1, 1940

LOCAL VOLUME TABLE[1/]
for
YELLOW POPLAR
(Liriodendron tulipifera)
in Stark County, Ohio

APR 31 1940
RESEARCH
INTERMOUNTAIN

INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	30	19.5	4	25	800	62	-
11	50	23	5	26	885	64	1
12	70	26.5	13	27	975	65.5	2
13	95	30	9	28	1065	67	1
14	125	33	9	29	1155	69	5
15	155	36.5	1	30	1245	70	9
16	190	40	5	31	1340	71.5	7
17	235	43	7	32	1435	72.5	7
18	285	45.5	6	33	1535	73.5	1
19	345	48	4	34	1630	74.5	1
20	405	51	2	35	1725	75	-
21	480	53.5	1	36	1825	76	-
22	555	56	2				
23	635	58	3				
24	720	60	1				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - the Ohio Woodland Survey. Measurements taken at 16-foot log lengths above a 2.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 107 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.8% low. Average percentage deviation of basic data from table, 19.4%.

INT - FILE COPY

O. D. DILLER
L. F. KELLOGG

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dup.

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U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 2 May 1, 1940

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ROCKY MOUNTAIN STATION

LOCAL VOLUME TABLE[1/]
for
CUCUMBER
(Magnolia acuminata)
in Stark County, Ohio

INTERNATIONAL Rule (¼" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
10	27	14	6
11	52	21	11
12	78	26	9
13	105	29.5	2
14	133	33	-
15	164	36	3
16	196	38.5	5
17	229	41	7
18	265	43	8
19	303	44.5	8
20	343	46	9
21	384	47	7
22	428	48	3
23	474	48.5	1
24	521	49	-
25	569	49	1

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 80 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.16% high. Average percentage deviation of basic data from table, 26.1%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central States region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2 feet above the ground) 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter b.h. and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

To use this table, measure the tree's diameter at 4-1/2 feet above the ground. Fractional inches should be rounded to the nearest even inch. The volume for the tree of this diameter on the average in Stark County, Ohio, is given in column 2. At the same time that the diameter is measured, estimate the length of the trunk which is merchantable or suitable for logs. Compare this estimate with the length in column 3. If shorter or longer, the volume in board feet will be lower or higher. There is no direct percent or rule-of-thumb method for making this correction. Judgment must be used.

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Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 3 May 1, 1940

LOCAL VOLUME TABLE[1/]
for
BASSWOOD
(Tilia glabra)
in Stark County, Ohio

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ROCKY MOUNTAIN STATION

INTERNATIONAL Rule (¼" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
10	36	19	3
11	52	21.5	5
12	73	24	8
13	94	27	6
14	119	39.5	4
15	146	32	8
16	175	34.5	10
17	210	37	5
18	250	39.5	4
19	293	42	4
20	341	44	2
21	392	46.5	2
22	446	48.5	3
23	501	50.5	2
24	561	53	1
25	620	54.5	1
26	680	56.5	1

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 16-foot log lengths above a 2.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 69 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.89% low. Average percentage deviation of basic data from table, 24%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central States region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2 feet above the ground) 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

To use this table, measure the tree's diameter at 4-1/2 feet above the ground. Fractional inches should be rounded to the nearest even inch. The volume for the tree of this diameter <u>on the average</u> in Stark County, Ohio, is given in column 2. At the same time that the diameter is measured, estimate the length of the trunk which is merchantable or suitable for logs. Compare this estimate with the length in column 3. If shorter or longer, the volume in board feet will be lower or higher. There is no direct percent or rule-of-thumb method for making this correction. Judgment must be used.

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Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
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CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 4

May 1, 1940

LOCAL VOLUME TABLE[1]/

for

RED OAK

(Quercus borealis)
in Stark County, Ohio

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ROCKY MOUNTAIN STATION

INTERNATIONAL Rule (¼" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	29	15.5	5	25	652	56	-
11	55	21.5	8	26	716	57	-
12	82	27	10	27	782	58	-
13	111	31	4	28	851	58.5	1
14	142	35	-	29	923	59.5	3
15	177	38	-	30	1000	60	6
16	211	41	-	31	1080	60.5	5
17	250	43.5	-	32	1164	61	2
18	290	45.5	1	33	1251	61.5	2
19	332	47	4	34	1340	62	2
20	379	49	9	35	1433	62.5	3
21	427	50.5	7	36	1929	62.5	1
22	480	52	2				
23	534	53.5	1				
24	591	55	1				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 77 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.95% low. Average percentage deviation of basic data from table, 15.0%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central States region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2 feet above the ground) 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

To use this table, measure the tree's diameter at 4-1/2 feet above the ground. Fractional inches should be rounded to the nearest even inch. The volume for the tree of this diameter on the average in Stark County, Ohio, is given in column 2. At the same time that the diameter is measured, estimate the length of the trunk which is merchantable or suitable for logs. Compare this estimate with the length in column 3. If shorter or longer, the volume in board feet will be lower or higher. There is no direct percent or rule-of-thumb method for making this correction. Judgment must be used.

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Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 5 May 1, 1940

LOCAL VOLUME TABLE[1/]
for
SUGAR MAPLE
(Acer Saccharum)
in Stark County, Ohio

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INTERNATIONAL Rule (¼" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	50	24	-	21	498	50.5	7
11	81	28	2	22	556	51.5	2
12	110	31.5	7	23	614	53	2
13	140	34.5	4	24	675	54	4
14	175	37	1	25	738	55	2
15	212	39.5	3	26	804	56	3
16	253	42	3	27	870	56.5	2
17	296	44	6	28	939	57.5	3
18	343	46	4	29	1010	58	3
19	394	47.5	3	30	1081	59	2
20	445	49	7	31	1154	59.5	2

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 72 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.35% high. Average percentage deviation of basic data from table, 16.2%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central State region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2) feet above the ground 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

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U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 6 May 1, 1940

LOCAL VOLUME TABLE[1/]

for

BLACK WALNUT

(Juglans nigra)

in Stark County, Ohio

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ROCKY MOUNTAIN STATION

INTERNATIONAL Rule (⅛" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	23	9	4	21	304	42	1
11	31	14	9	22	343	43.5	2
12	42	19	8	23	383	45	2
13	57	22.5	7	24	425	46.5	-
14	75	26	6	25	468	47.5	-
15	101	29	5	26	513	49	-
16	130	31.5	7	27	558	50	-
17	162	34	3	28	604	50.5	1
18	195	36	7	29	650	51.5	2
19	230	38	4	30	698	52	1
20	266	40	4				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 73 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.75% low. Average percentage deviation of basic data from table, 28.5%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central State region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2) feet above the ground 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

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Ohio Agricultural Experiment Station,
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CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 7 May 1, 1940

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ROCKY MOUNTAIN STATION

LOCAL VOLUME TABLE[1/]

for

WHITE ASH

(Fraxinus americana)

in Stark County, Ohio

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
10	28	15.5	3
11	52	20.5	9
12	77	25.5	12
13	104	29.5	6
14	132	33.5	-
15	161	36.5	1
16	192	39.5	8
17	225	42	4
18	257	44	7
19	293	46	8
20	327	47	7
21	364	48	5
22	402	48.5	4
23	440	49	6
24	479	49	1

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 81 trees.

Table prepared, in 1940, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.0+% low. Average percentage deviation of basic data from table, 5.81%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central State region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2) feet above the ground 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

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Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 8 May 1, 1940

LOCAL VOLUME TABLE[1/]

for

HICKORIES

(Hicoria Spp.)
in Stark County, Ohio

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

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ROCKY MOUNTAIN STATION

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
10	22	13	6
11	39	18	7
12	60	22.5	4
13	85	26.5	3
14	112	30.5	3
15	143	34.5	2
16	177	38.5	1
17	219	42.0	2
18	267	45	3
19	321	48	2
20	381	51	1
21	446	53.5	1
22	517	56	1
23	593	58.5	1
24	675	60.5	-

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 37 trees.

Table prepared, in 1940, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.36% low. Average percentage deviation of basic data from table, 20.3%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central State region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2) feet above the ground 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower those volumes.

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In Cooperation With
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CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 9 May 1, 1940

LOCAL VOLUME TABLE[1/]

for

WHITE OAK

(Quercus alba)
in Stark County, Ohio

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

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FEB 12 1968
ROCKY MOUNTAIN STATION

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	40	14	1	25	619	48.5	-
11	50	18.5	8	26	684	50	-
12	62	22	8	27	751	51	-
13	80	25.5	9	28	820	52	-
14	104	28	1	29	894	53	3
15	130	30.5	-	30	965	54	7
16	162	33	-	31	1040	55	4
17	198	35	-	32	1116	56	5
18	237	37	8	33	1194	57	3
19	282	39	9	34	1270	58	3
20	330	41	6	35	1350	59	2
21	380	42.5	2	36	1428	60	-
22	435	44	1	37	1505	61	2
23	494	45.5	-	38	1584	61.5	1
24	555	47	-				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 83 trees.

Table prepared, in 1939, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.34% low. Average percentage deviation of basic data from table, 17.6%.

(over)

A local volume table, as its name implies, is suitable for local use. At the same time, when site conditions and terrain do not change materially over a considerable area, county lines do not bound the locality where a table of this type may be of some utility. The general lack of volume tables for the many hardwood species in Ohio, as well as in the Central State region, places some value on almost any tabulation which assists in the estimation of tree volumes. This table provides volumes in board feet by the International rule (1/4-inch saw kerf) for trees with diameters at breast height (4-1/2) feet above the ground 10 inches and over as shown. These volumes are the average of trees on good, medium, and poor sites. Obviously, trees with longer or shorter merchantable lengths than those indicated in column 3 will contain a larger or smaller volume than those shown. The farmer or landowner who consults this table should approximate the merchantable lengths of the trees being estimated and compare them with those shown. This comparison will enable him to judge whether he should raise or lower these volumes.

These tree data are being analyzed to prepare an additional volume table to read in volume by diameter breast high and merchantable height by log lengths. This second table will provide a closer estimate of volume because of the addition of the factor of height. As additional tree data become available, they will be analyzed for differences in volume, and, if desirable, will be combined into tables with a broader base.

To use this table, measure the tree's diameter at 4-1/2 feet above the ground. Fractional inches should be rounded to the nearest even inch. The volume for the tree of this diameter on the average in Stark County, Ohio, is given in column 2. At the same time that the diameter is measured, estimate the length of the trunk which is merchantable or suitable for logs. Compare this estimate with the length in column 3. If shorter or longer, the volume in board feet will be lower or higher. There is no direct percent or rule-of-thumb method for making this correction. Judgment must be used.

O.D. Diller

L.F. Kellogg

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MARK TWAIN NATIONAL FOREST[1]/
Springfield, Missouri

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Technical Note 10 July 1, 1940

ESTABLISHMENT OF SHORTLEAF PINE IN THE MISSOURI OZARKS FOLLOWING SEED BED PREPARATION AND RELEASE[2]/

By

J. Milton Attridge, Junior Forester
(Civilian Conservation Corps)

and

Franklin G. Liming, Associate Silviculturist

Natural regeneration of shortleaf pine in many of the stands in the Missouri Ozarks is not occurring at a sufficiently rapid rate to assure the percentage of pine considered necessary for a well-balanced mixed oak - pine forest. The distribution of the existing pine reproduction is spotted and relatively more abundant along abandoned tramways, road banks and other open places where mineral soil has been exposed or disturbed. This indicates that it might be possible through some method of seed bed preparation prior to seed fall or artificial seeding to supplement the present rather slow and costly practice of planting. In the fall of 1938 an experiment was initiated to study the effects of five seed bed treatments under two densities of overstory on germination and the subsequent behavior of pine seedlings.

The Study

This study was established in Howell County on the Willow Springs Ranger District of the Mark Twain National Forest. Four

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1/ The majority of the field work in connection with this study was done by CCC enrollees from Camp F-12 under the direction of John L. Arend, Junior Forester (CCC).

2/ Assistance in analysis of data for this report was furnished by the personnel of the Works Progress Administration's official project No. 01-2-42-446.

Latin squares, each having 25 milacre plots, were laid out in second growth oak-pine pole stands in which there was no current crop of pine seed. The topography in this vicinity is level to rolling and the soil is predominantly Clarksville gravelly loam.

After the Latin squares were laid out, two of them were selected at random and about 75 percent of the overstory was removed. The milacre plots on all the squares were then given the following treatments: a, removal of litter with a rake; b, removal of litter and cultivation of the soil; c, cultivation of litter into the soil; d, removal of litter by burning; and e, check. This was followed by the broadcast sowing of native shortleaf pine seed at the rate of 5 pounds per acre. The seed was only 40 percent viable and since there were fifty thousand per pound approximately 100 viable seeds fell on each milacre plot.

The amount of germination was obtained from a count of the seedlings on each plot in June, 1939. A second set of observations was made in the fall of 1939 to ascertain height growth and survival during the summer. Additional observations will be made in succeeding years to check on subsequent mortality and height growth.

Results

The effects of the five seed bed treatments on germination, and the survival and height growth of pine seedlings in oak-pine pole stands with open and dense overstories are shown graphically in Figure 1.

The germination of pine seed on plots receiving treatment b (litter removed and soil cultivated) was significantly better than that on the plots receiving any other treatment, including the check plots, regardless of the density of the overstory. The differences in the amount of germination between treatments a, c, d, and e were not significant. For all types of seed bed preparation, germination was significantly greater on the unreleased plots.

With regard to the number of seedlings surviving at the end of the first summer under released and unreleased conditions, treatment b was again superior to the others. Likewise, differences between the other methods of treatment were not significant. The mortality on the released plots was lower for all treatments. However, there was no appreciable difference within any treatment in the number of seedlings surviving on the released and unreleased plots at the end of the first growing season.

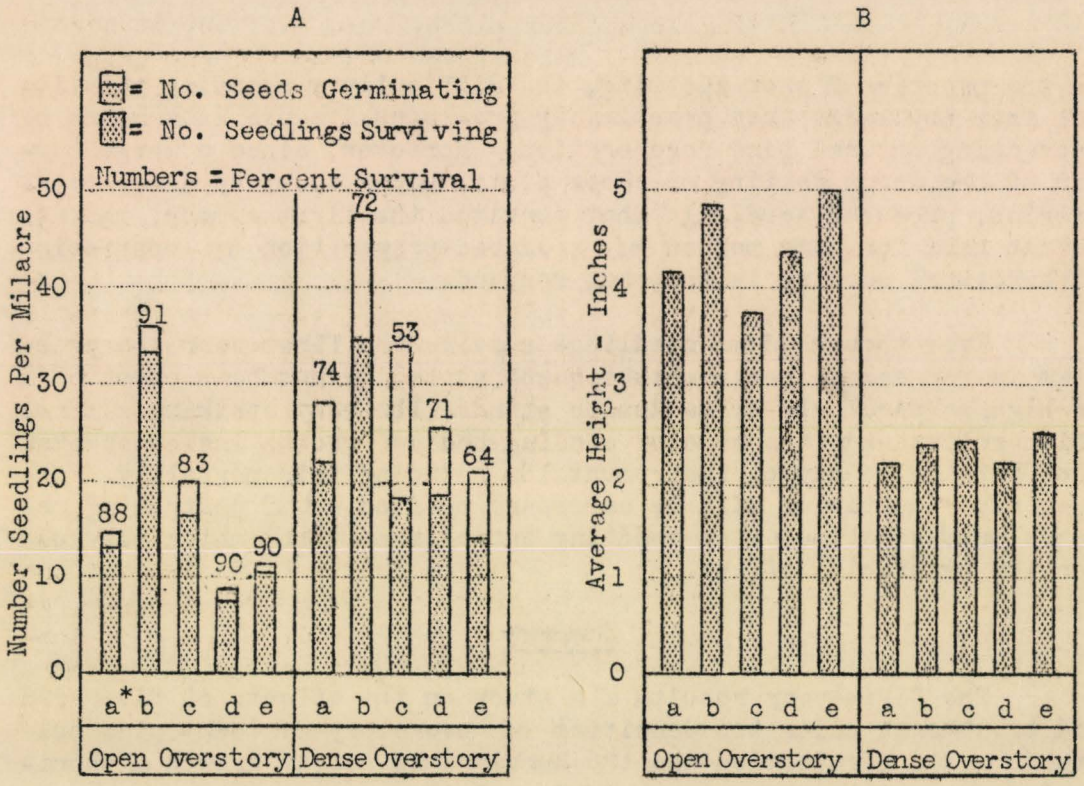

Fig. 1--Effects of five seed bed treatments under two densities of overstory on (A) germination and survival, and (B) the height of shortleaf pine seedlings after one growing season.

* The treatments are: a, removal of litter with a rake; b, removal of litter and cultivation of soil; c, cultivation of litter into the soil; d, removal of litter by burning; and e, check.

Although the growth of the surviving pine seedlings was not materially affected by seed bed treatment, the effects of release were very obvious. The foliage was denser, had a darker green color, and the height growth was increased 100 percent.

Discussion

The removal of litter plus cultivation of the soil was the only one of the five treatments that resulted in a significant increase in germination and the number of pine seedlings surviving after one growing season. Although this treatment might be well suited

to the practice of seed spotting, the difficulty of removing the litter from any large area practically precludes its use as a means of increasing natural pine regeneration. Moreover, since a large number of the seeds falling on check plots, under open and dense overstories, produced seedlings that survived the first summer, the apparent need for some method of seed bed preparation in connection with natural seeding is somewhat reduced.

Even though pine seedlings survive the first year the problem is not solved because subsequent mortality has been observed to be high, particularly in the denser stands. The very striking effect which release at the time of seeding had on growth indicates that such a practice may be instrumental in reducing this mortality. Further experimentation will be necessary to find out if postponing release until sometime after seedling establishment will materially alter its beneficial effect.

Summary

The first-year results of a study on the effects of five seed bed treatments under two densities of overstory in oak-pine pole stands on the germination and the survival and height growth of shortleaf pine seedlings are summarized as follows:

1. Broadcast seeding of pine at the rate of 250 seeds per milacre produced, on the average, 12 seedlings per milacre on the check plots at the end of the first growing season.

2. The removal of litter and cultivation of soil was the only treatment that resulted in a significantly better germination and survival of seedlings.

3. The height growth of seedlings was not appreciably affected by seed bed preparation.

4. Removal of 75 percent of the overstory did not result in a significant change in the number of surviving seedlings after one growing season.

5. Release resulted in a 100-percent increase in the height growth and a decided increase in plant vigor.

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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note
No. 11

August 15, 1940.

A PORTABLE INFILTROMETER AND UNIT SYSTEM FOR DETERMINING RELATIVE INFILTRATION RATES

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John L. Arend, Junior Forester
and
D. Manley Knight, Assistant Silviculturist

To ascertain the rate of water intake of a soil profile under different conditions of land use, various types of run-off plots, lysimeters, rain-simulators, tube apparatus, and the more recently developed portable infiltrometer have been used. The principal disadvantages in using most of the above equipment and methods for determining the relative infiltration rates of the numerous soil and vegetative cover conditions typical of any large watershed embracing several thousand square miles, are the difficulties of simulating natural rainfall and of making sufficient tests within reasonable cost and time limits to obtain reliable results. The infiltrometer and unit system herein described are especially adapted for the rapid determination of relative infiltration rates of areas comprising numerous soil series, cover conditions and land uses, and it is believed the apparatus has considerable possibilities in view of the current need for infiltration data on Flood Control Surveys. The general appearance of this unit in operation is given in Figure 1 and the specifications and details of construction are indicated in Figure 2.

The test quadrat of each infiltrometer is 18 inches wide and 20 inches long and has a surface area of 2-1/2 square feet. The plot boundaries are delineated by No. 10 gage galvanized steel forced into the ground approximately six inches. A small trough with a 1/2-inch outlet is welded to the front border and catches the surface run-off from the plot. Water caught in this run-off trough drains through a 1/2-inch copper tube to a collection basin where it is measured by means of a graduate in cubic centimeters.

"Rainfall" is applied artificially by means of one to three nozzles1/ located about two feet above the edge of the plot. Water enters the nozzles under a pressure of 15 pounds per square inch which is provided by a centrifugal pump and 3/4 - 1 hp. gasoline motor. A uniform rainfall intensity is maintained by regulating a constant pressure on each supply line by a special system of valves and pressure gages called "manifold" and a pressure regulator2/ at the nozzle assembly. Irregularities in the pressure supply commonly developed from slight fluctuations in motor speed are overcome by installing

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1/ Nozzle developed by Hydraulic Laboratory, Soil Conservation Service, Division of Research, Washington, D. C.

2/ Watts Pressure Regulator No. 26AC. Size 3/8". Stock Setting 15 lbs. Watts Regulator Company, Lawrence, Mass.

a small surge tank in the supply line near the pump outlet. The spray is forced upward over the plot and falls five to six feet in the form of fairly large drops uniformly distributed. The size of the area wetted by one infiltrometer during a test is four by four feet, or 16 square feet, whereas run-off measurements are made only for the centrally located plot having a surface area of 2-1/2 square feet. The rainfall intensity varies according to the number of nozzles in operation since each nozzle contributes approximately two inches of water per hour.

The exact amount of water falling on the test quadrat is ascertained by means of a pan one inch deep which fits over the plot borders and has a surface area equal to that of the plot. The water falling on this calibration pan drains into the collection basins and is measured in the same manner as surface run-off.

A collapsible pipe frame and canvas cover are erected around each plot to eliminate the effects of wind movement on the spray. The dimensions of the windbreak when fully assembled are four by four feet and seven feet high.

One to four infiltrometers can be operated efficiently in a unit, thereby increasing the number of replications possible in the same period of time required to make a single test. Sufficient hose should be provided so that the infiltrometers are well distributed over the sampling site on which the testing unit is located. The most economical number of infiltrometers to use in a unit depends on the number of tests desired on each sample site. Two to three unit set-ups can be made in an eight-hour day, depending on the distance the equipment is moved between set-ups. One complete unit of four infiltrometers and power unit can be transported by a one-half ton pick-up. The water supply should be transported on a separate truck

The operating procedure is extremely simple. After the exact location of the plot has been ascertained, the plot borders are forced into the soil to a depth of approximately six inches so that the run-off trough is flush with the surface of the ground. The plots borders are installed so that the run-off trough is always at the lowest end of the plot. The windbreak frame is then assembled. The nozzle arrangement is installed at one side of the plot and held in place by two iron stakes and the adjustment collars. The area between the plot borders and windbreak is covered with canvas to prevent excessive wetting when checking the "rainfall" intensity. A shallow hole is dug about 10 inches in front of the windbreak for the run-off collection basins and the drain pipe from the run-off trough to the collection basin is set in place. The fitting of the canvas cover over the windbreak frame completes the installation.

The calibration pan is placed over the plot to check the "rainfall" intensity prior to the test. Run-off from this pan is caught in the collection basins and measured in a liter graduate at one- or two-minute intervals. When the intensity is ascertained, the calibration pan and canvas are removed from inside the windbreak and the time is recorded or stop watch started. Run-off from the plot is measured at one-, two- or five-minute intervals, depending on the amount and rate of increase. Run-off in cubic centimeters per minute is converted to inches per hour by multiplying by the factor .01018 or roughly one cubic centimeter per minute equals .01 inch per hour.

The run-off from the plot gradually increases to a maximum, which when reached, remains fairly constant. If it remains practically constant for a period of 30 minutes, the test is usually completed. The calibration pan is again placed over the plot to recheck the rainfall intensity and determine any change in rate which might have occurred during the test. Since the amount of water retained on a plot 18 by 20 inches by depression storage and surface retention is very small, the difference between rate of run-off and rate of "rainfall" applied can be used as the infiltration rate at any particular time of the test for all practical purposes. However, if desired, the amount of water retained on the plot as depression storage and surface retention can be ascertained by a hydrograph analysis as developed by Sharp and Holtan 3/.

The total cost of all equipment required for one infiltrometer unit consisting of four infiltrometers and capable of making 12 runs per day, as in Figure 1, is approximately $350.00. One man is required to assemble and operate each infiltrometer used in the unit. One man is required to assemble the pressure system, service the power unit and regulate the water pressure for all infiltrometers at the centrally located manifold during the runs.

3/ Sharp, A. L., and H. M. Holtan.
1940. A Graphical Method of Analysis of Sprinkled Plot Hydrographs.
Paper presented at Hydrology Section, Amer. Geo. Union., Washington, D. C.

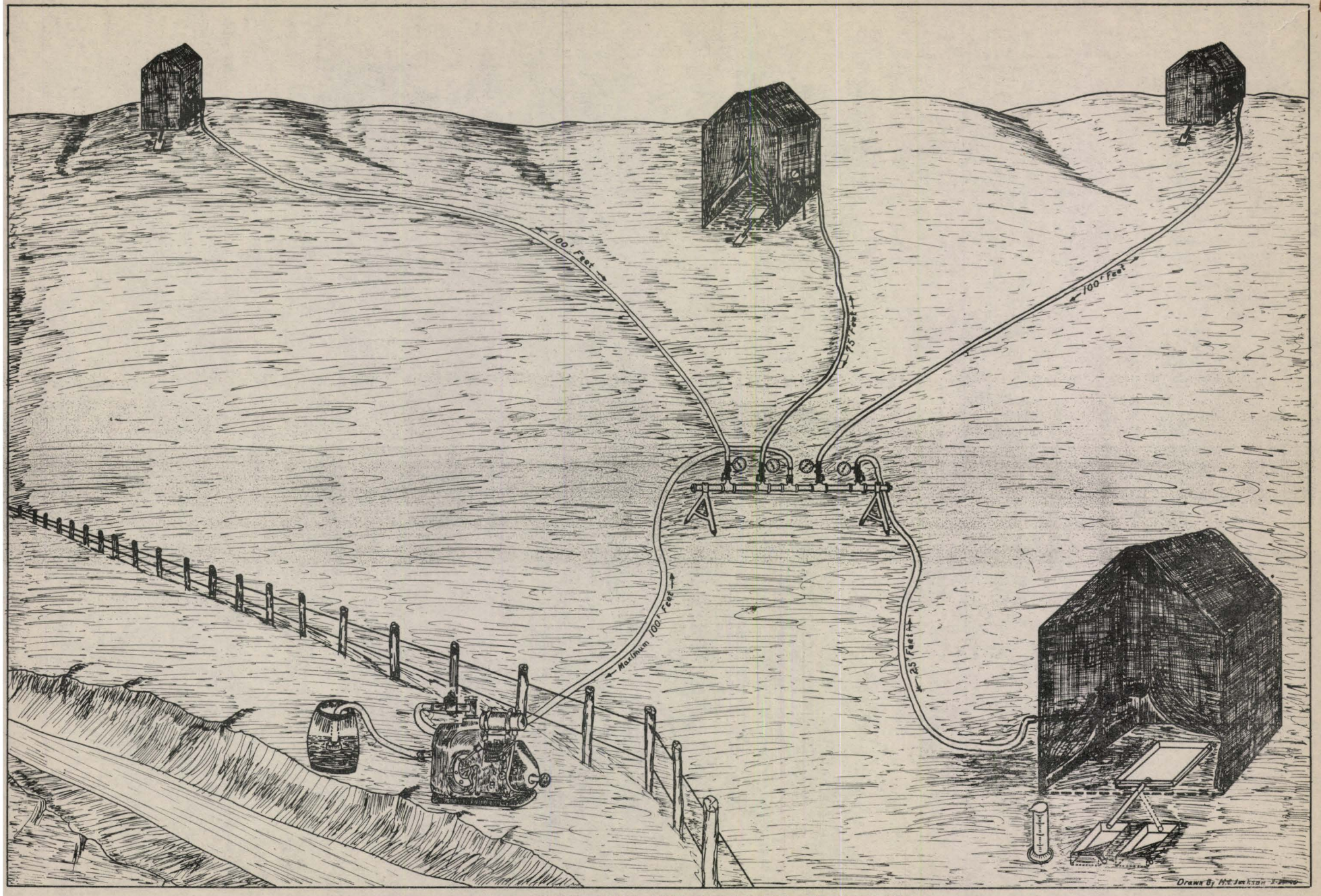

FIGURE I. A UNIT OF FOUR INFILTROMETERS IN OPERATION

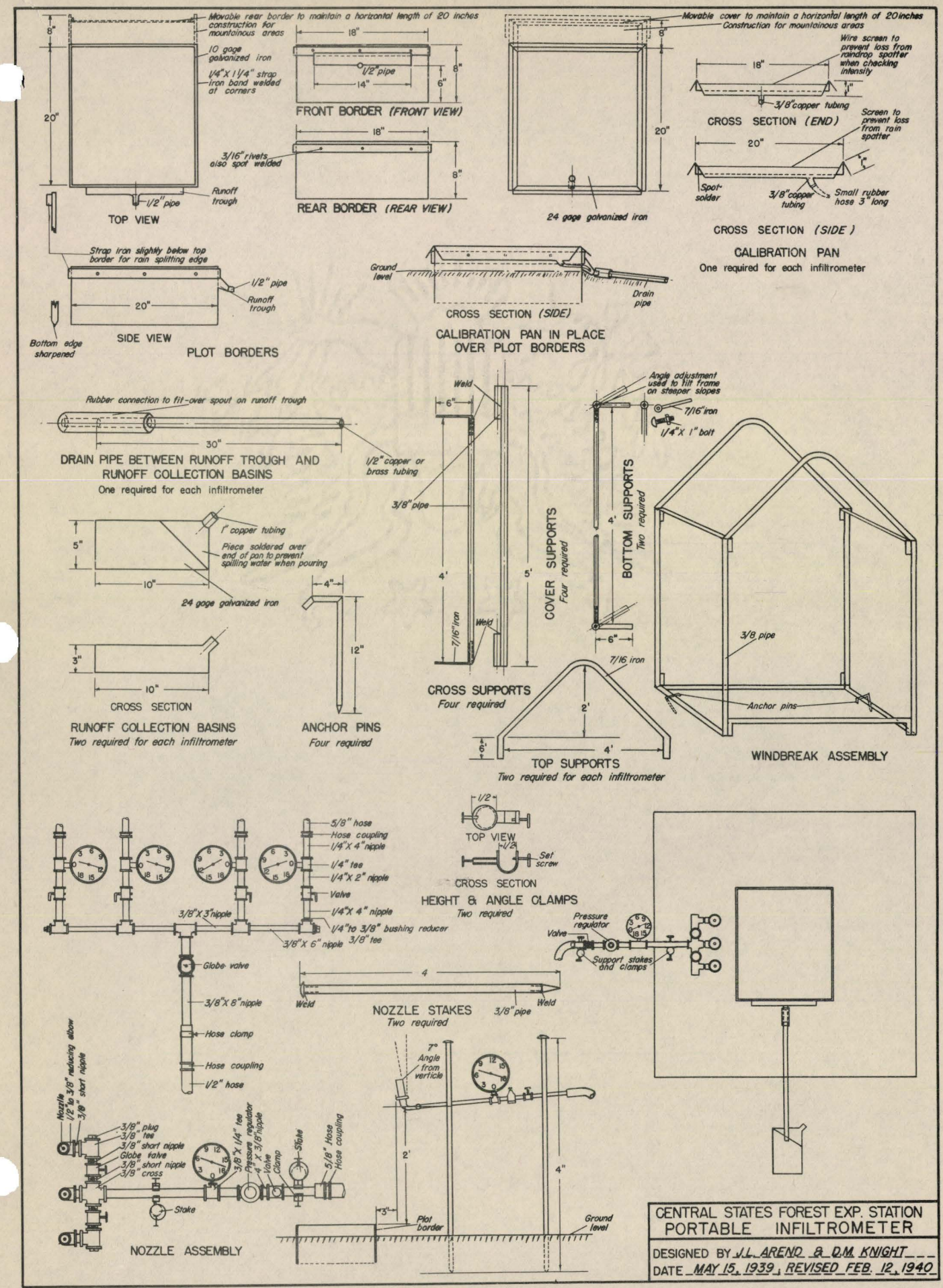
Movable rear border to maintain a horizontal length of 20 inches construction for mountainous areas
10 gage galvanized iron
1/4"X 1 1/4" strap iron band welded at corners
3/16" rivets also spot welded
1/2" pipe
Runoff trough
TOP VIEW
FRONT BORDER (FRONT VIEW)
REAR BORDER (REAR VIEW)
Movable cover to maintain a horizontal length of 20 inches
Construction for mountainous areas
24 gage galvanized iron
Wire screen to prevent loss from raindrop spotter when checking intensity
3/8" copper tubing
CROSS SECTION (END)
Screen to prevent loss from rain spotter
Spot-solder
Small rubber hose 3" long
CROSS SECTION (SIDE)
CALIBRATION PAN
One required for each infiltrometer
Strap iron slightly below top border for rain splitting edge
Bottom edge sharpened
SIDE VIEW
PLOT BORDERS
Ground level
Drain pipe
CROSS SECTION (SIDE)
CALIBRATION PAN IN PLACE OVER PLOT BORDERS
Rubber connection to fit-over spout on runoff trough
DRAIN PIPE BETWEEN RUNOFF TROUGH AND RUNOFF COLLECTION BASINS
One required for each infiltrometer
1/2" copper or brass tubing
1" copper tubing
Piece soldered over end of pan to prevent spilling water when pouring
24 gage galvanized iron
CROSS SECTION
RUNOFF COLLECTION BASINS
Two required for each infiltrometer
ANCHOR PINS
Four required
Weld
3/8" pipe
7/16" iron
COVER SUPPORTS
Four required
CROSS SUPPORTS
Four required
Angle adjustment used to tilt frame on steeper slopes
1/4"X 1" bolt
BOTTOM SUPPORTS
Two required
TOP SUPPORTS
Two required for each infiltrometer
Anchor pins
WINDBREAK ASSEMBLY
5/8" hose
Hose coupling
1/4"X 4" nipple
1/4" tee
1/4"X 2" nipple
Valve
1/4"X 4" nipple
1/4" to 3/8" bushing reducer
3/8" tee
3/8"X 3" nipple
3/8"X 6" nipple
Globe valve
3/8"X 8" nipple
Hose clamp
Hose coupling
1/2" hose
TOP VIEW
Set screw
CROSS SECTION
HEIGHT & ANGLE CLAMPS
Two required
Pressure regulator
Valve
Support stakes and clamps
NOZZLE STAKES
Two required
Nozzle
1/2" to 3/8" reducing elbow
3/8" short nipple
3/8" plug
3/8" tee
3/8" short nipple
Globe valve
3/8" short nipple
3/8" cross
3/8"X 1/4" tee
Pressure regulator
4" X 3/8" nipple
Valve
Clamp
Stake
5/8" Hose
Hose coupling
Stake
NOZZLE ASSEMBLY
7° Angle from verticle
Plot border
Ground level
CENTRAL STATES FOREST EXP. STATION
PORTABLE INFILTROMETER
DESIGNED BY J.L. AREND & D.M. KNIGHT
DATE MAY 15, 1939, REVISED FEB. 12, 1940

FIGURE 2

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OHIO DIVISION OF FORESTRY

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Technical Note 12.

August 1 1940.

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VOLUME TABLE 1/
for
YELLOW POPLAR (Lirio. tulip.)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — International Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Volume of merchantable stem in 16.3-foot logs						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	28	57					4
11	36	73	108				5
12	43	89	130				13
13	52	105	154				9
14		122	180	237			9
15		137	203	266			4
16		155	229	301			5
17		173	255	334			7
18		190	280	367	453		7
19		208	306	402	496		5
20			333	436	538		6
21			361	475	579		3
22			393	515	630		2
23			425	557	685		3
24			457	602	740		5
25			497	652	804		4
26			535	703	875		3
27			580	763	943		4
28			630	824	1023		2
29			689	904	1114	1318	9
30			752	991	1222	1445	11
31			828	1086	1340	1595	10
32			915	1194	1478	1753	8
33			1002	1315	1622	1919	3
34			1107	1452	1791	2118	4
35			1233	1618	1995	2350	1
36				1791	2208	2612	1
37						2924	1
Basis in trees--number	4	22	45	35	30	12	148

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 16-foot log lengths above a 2.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared, in 1940, by the equation method. Coefficient of multiple correlation (R) = .987. Standard error of estimate, 84.9 to 118.0 percent. Block shows limits of basic data.

A. G. ADMAN
O. D. DILLER

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CENTRAL STATES FOREST EXPERIMENT STATION
In Cooperation With
Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY

Technical Note 13. August 1, 1940.

VOLUME TABLE 1/
for
CUCUMBER TREE
(Magnolia acuminata)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height					Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
12	25	64	107	148	-	13
13	29	73	119	167	-	2
14		82	131	187	248	-
15		91	145	207	275	3
16		100	159	227	302	5
17		109	174	248	330	7
18		119	192	269	358	8
19		130	211	292	388	7
20			233	320	427	8
21			262	362	480	7
22			300	419	550	3
23				495	654	1
24					770	-
25					930	1
Basis in trees--number	0	12	18	21	14	65

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = .949. Standard error of estimate, 80.4 to 124.2 percent.

A. G. ADMAN
O. D. DILLER

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Technical Note 14. August 15, 1940.

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VOLUME TABLE 1/
for
PASSWOOD
(Tilia glabra)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 16.3-foot logs to merchantable height				Basis in trees
	1 log	2 logs	3 logs	4 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	26	53	79		3
11	34	68	101		5
12	42	85	125		8
13	51	104	155		6
14	60	124	183	243	4
15	72	146	216	282	8
16		168	246	323	10
17		190	280	365	5
18		212	310	410	4
19		235	345	455	4
20		259	380	500	2
21		307	417	546	2
22			453	593	3
23			490	644	2
24			528	697	1
Basis in trees--number	10	23	24	10	67

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 16-foot log lengths above a 2.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = 0.984. Standard error of estimate, 86.1 to 116.1 percent. Block shows limits of basic data.

A. G. ADMAN

O. D. DILLER

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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note
No. 15.

July 15, 1940.

GROWTH RESPONSE OF PLANTED PITCH PINE TO DIFFERENTIAL PRUNING

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FEB 12 1968

ROCKY MOUNTAIN STATION

by

Thomas F. McLintock, Junior Forester,
Civilian Conservation Corps.

Appreciation of the character of growth response to be expected following different pruning intensities is important in establishing pruning practices in planted stands of young pitch pine (Pinus rigida Mill). While the benefits derived through improved wood quality consequent to pruning have in a general way been recognized, optimum pruning practices on the basis of either highest wood quality or maximum tree growth have not been defined to a satisfactory degree.

This paper is a preliminary report on the results of an experiment initiated in 1939, designed to obtain specific information on growth of planted pitch pine following different degrees of pruning. The study has been set up on a long-time basis and subsequent prunings will be made at expedient intervals, as dictated to a large degree by the growth and development of the trees. The area under examination was planted with 1-1 stock in 1935, and is located at the Southern Illinois Branch of the Central States Forest Experiment Station, Hardin County, Illinois.

The plantation was divided into three strips, each about one-third acre, and each containing an average of 470 trees on a six-by-six spacing. On each of the strips about 200 crop trees were selected on the basis of form, spacing and thrift. At the time of pruning these trees averaged 6.17 feet in height, with diameters at 1.5 and 4.5 feet of 1.91 and 1.36 inches, respectively. Four degrees of pruning were assigned at random, each to one-quarter of the crop trees on each strip: (1) No pruning, i.e., left as check; (2) light pruning, only lower branches up to about 1.5 feet removed, and on many of these the needles had already died or were turning brown; (3) moderate pruning to an average height of 2.75 feet or slightly less than half the crown removed; (4) heavy pruning, two-thirds to three-quarters of the crown to an average of 3.8 feet removed.

Immediately following the pruning, measurements of total height were taken on all trees. Diameters at 1.5 and 4.5 feet were measured to 0.1 inch with a tree fork especially adapted to this use. At the termination of the growing season these measurements were repeated, and will be retaken each fall. Additional diameter measurements at three-foot intervals on the stem will be made as the trees attain sufficient size and further prunings are made. In table 1 is presented a summary of mean height and diameter increments at two points on the stem for four degrees of pruning.

Table 1. Mean diameter and height increments of pitch pine during first growing season following pruning

Intensity of Pruning	Diameter Increment at 1.5 ft.	Diameter Increment at 4.5 ft.	Height Increment
	Inches	Inches	Feet
None (Check)	0.363	0.496	2.18
Light	0.343	0.452	2.23
Moderate	0.300	0.444	2.05
Heavy	0.222	0.412	2.05

The three strips were replicates and pruning effects in terms of increment were evaluated according to an analysis of variance. Even though these results represent only the first-season response, there were strong indications of differences arising, presumably as a consequence of pruning. In every case there was a gradation of growth from unpruned to heavily pruned trees. This difference in the case of total height was but 0.13 feet and was not significant. Differences in diameter growth, however, were much more clearly defined.

Diameter increment at 1.5 feet on heavily pruned trees was significantly less than the corresponding increment on lightly pruned and unpruned trees. The differences were 0.121 and 0.141 inches, respectively, or 35 and 39 percent of the mean increment of unpruned trees. Other increment differences between treatments were nonsignificant, the greatest being a "loss" of 0.078 inches between moderate and heavy pruning. Diameter growth differences at 4.5 feet attained the 20 percent level of probability but were not significant.

The retarding effect of heavy pruning upon diameter increment is much less pronounced at 4.5 feet than that at 1.5 feet. This is illustrated in the table by the fact that the diameter increment "decrease" from no pruning to heavy pruning at 4.5 feet is 0.084 inches or 16.9 percent of check, as compared to a "decrease" at 1.5 feet of 0.141 inches or 35.8 percent. There is manifest in these relationships a trend in heavily pruned trees toward a more cylindrical stem. It is of course too early to draw conclusions as to the future development of tree form as modified by pruning, but should the present trend continue as the trees mature, a possibly superior, more cylindrical bole will result. It is recognized that this improvement in form, should it occur, would at first probably be at the expense of diameter increment. However, it is also possible that after prunings have been completed, presumably at a relatively early age, this increment will be regained in subsequent years' growth.

In summary, it appears from the preliminary results of this investigation that during the first year following pruning of pitch pine: (1) Height growth was not affected by any degree of pruning tested; (2) diameter growth was not materially affected by light or moderate pruning; (3) heavy pruning resulted in a relatively heavy loss in diameter increment; and (4) this loss in increment is less at the upper (4.5-foot) than at the lower (1.5-foot) diameter, thus tending to develop a more cylindrical stem.

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Technical Note 16.

August 15, 1940.

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VOLUME TABLE 1/
for
Northern RED OAK
(Quercus borealis)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	20	54	95				5
11	23	64	110				8
12	27	74	123	191			10
13		84	137	215			4
14		94	152	238			-
15		105	167	259			-
16			182	281	378		-
17			198	302	406	515	-
18			215	322	436	550	1
19			230	338	455	583	4
20			248	365	490	622	9
21			265	389	522	664	7
22			281	412	555	703	2
23			301	443	594	755	1
24			324	475	638	811	1
25			351	515	692	879	-
26			383	562	755	959	-
27			420	617	828	1052	-
28			465	682	916	1155	1
29			507	745	1000	1271	3
30			556	817	1096	1400	6
31			607	891	1197	1532	5
32				980	1305	1671	2
33				1067	1432	1833	2
34				1164	1555	1991	2
35				1259	1690	2148	3
36				1365	1832	2328	1
Basis in trees--number	1	13	16	13	22	12	77

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = 0.986. Standard error of estimate, 82 to 122 percent. Block shows limits of basic data.

A. G. ADMAN

O. D. DILLER

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Technical Note 17.

August 1, 1940.

VOLUME TABLE 1/ for SUGAR MAPLE (Acer saccharum) Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	30	51	68	83			-
11	38	65	87	106			2
12	48	81	109	133			7
13	59	99	135	162	188		4
14	71	121	162	197	230	260	1
15		142	190	231	269	305	3
16		165	220	269	313	354	3
17		188	251	307	358	404	6
18		215	284	347	404	457	4
19		242	323	394	458	519	3
20		268	358	437	508	575	7
21		296	395	482	561	635	7
22		324	433	527	614	695	2
23				574	668	757	2
24				623	724	817	4
25				673	783	887	2
26				721	840	951	3
27				771	897	1016	2
28				822	957	1084	3
29					1014	1148	3
30					1074	1221	2
31					1140	1291	2
32					1202	1361	-
33					1276	1445	-

Basis in trees--number	-	6	7	24	27	8	72

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 -- "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 3 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = .983. Standard error of estimate, 86.7 to 115.3 percent.

A. G. ADMAN

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Technical Note 18.

August 15, 1940.

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VOLUME TABLE 1/
for
BLACK WALNUT
(Juglans nigra)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
8	6	-	-	-	-	-	1
9	9	21	-	-	-	-	1
10	13	30	46	-	-	-	4
11	17	39	61	-	-	-	9
12	22	49	77	104	-	-	8
13	27	61	95	129	-	-	7
14	33	72	114	155	-	-	6
15	38	83	133	180	230	279	5
16	44	95	150	204	264	317	7
17	-	107	169	230	294	354	3
18	-	120	187	255	325	391	7
19	-	132	205	280	356	430	4
20	-	145	225	307	390	468	4
21	-	157	244	334	422	509	1
22	-	171	264	360	455	549	2
23	-	183	284	386	489	590	2
24	-	-	305	413	522	632	-
25	-	-	325	442	560	676	-
26	-	-	347	472	596	722	-
27	-	-	372	506	638	773	-
28	-	-	399	542	684	826	1
29	-	-	429	582	735	889	2
30	-	-	463	630	796	962	1
31	-	-	511	692	875	1057	-
Basis in trees--number	14	18	23	12	6	2	75

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 16-foot log lengths above a 1.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = 0.985. Standard error of estimate, 82.2 to 121.6 percent. Block shows limits of basic data.

A. G. ADMAN.

O. D. DILLER.

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VOLUME TABLE 1/ for BLACK WALNUT (Juglans nigra) Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
8	6	-	-	-	-	-	1
9	9	21	-	-	-	-	1
10	13	30	46	-	-	-	4
11	17	39	61	-	-	-	9
12	22	49	77	104	-	-	8
13	27	61	95	129	-	-	7
14	33	72	114	155	-	-	6
15	38	83	133	180	230	279	5
16	44	95	150	204	264	317	7
17	-	107	169	230	294	354	3
18	-	120	187	255	325	391	7
19	-	132	205	280	356	430	4
20	-	145	225	307	390	468	4
21	-	157	244	334	422	509	1
22	-	171	264	360	455	549	2
23	-	183	284	386	489	590	2
24	-	-	305	413	522	632	-
25	-	-	325	442	560	676	-
26	-	-	347	472	596	722	-
27	-	-	372	506	638	773	-
28	-	-	399	542	684	826	1
29	-	-	429	582	735	889	2
30	-	-	463	630	796	962	1
31	-	-	511	692	875	1057	-
Basis in trees--number	14	18	23	12	6	2	75

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 16-foot log lengths above a 1.0-foot stump height. Scaled as 16-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1940, by the equation method. Coefficient of multiple correlation (R) = 0.985. Standard error of estimate, 82.2 to 121.6 percent. Block shows limits of basic data.

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VOLUME TABLE 1/
for
WHITE ASH
(Fraxinus americana)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	20	47	74	100			3
11	23	55	88	119			9
12	26	64	101	138			12
13	30	73	115	157			6
14	34	82	129	116	222		-
15	38	91	141	192	244		1
16	42	99	155	211	267		8
17	46	108	169	230	290	352	4
18	50	118	185	252	318	386	7
19	54	128	201	275	348	421	8
20	60	142	223	303	385	465	7
21	67	158	248	339	429	519	5
22		177	279	380	481	582	4
23		197	311	424	536	655	6
24		225	354	482	611	738	1
25		253	399	543	689	832	3
26		286	451	614	778	940	2
27			511	697	881	1064	1
28			572	778	986	1191	-
29			638	871	1102	1334	-
Basis in trees--number	4	18	21	16	23	5	87

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared, in 1940, by the equation method. Coefficient of multiple correlation (R) = .981. Standard error of estimate, 81.3 to 123.0 percent. Block shows limits of basic data.

A. G. ADMAN

O. D. DILLER

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Technical Note 20.

August 15, 1940.

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VOLUME TABLE 1/
for
WHITE OAK
(Quercus alba)
Stark County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼"Kerf)

Diameter breast high outside bark (inches)	Volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
10	19	37	54				1
11	24	47	68				8
12	30	59	86	111			8
13	37	73	106	137			9
14	45	89	129	166			1
15		104	153	198			-
16		122	177	229			-
17		141	205	265			-
18		163	236	305			8
19		185	269	348			9
20		198	302	392			6
21		233	338	437			2
22		254	374	483			1
23		279	406	530			-
24			447	577	715		-
25			484	625	770		-
26			520	678	826		-
27			560	723	880		-
28			598	768	935		-
29				819	990	1170	3
30				863	1045	1235	7
31				914	1100	1300	4
32				965	1155	1365	7
33					1216	1430	1
34					1275	1495	3
35					1330	1560	2
36					1390	1625	-
37					1450	1690	2
38					1505	1760	1
Basis in trees--number	3	21	17	19	12	11	83

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared, in 1940, by the equation method. Coefficient of multiple correlation (R) = .996. Standard error of estimate, 89.1 to 112.2 percent. Block shows limits of basic data.

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O. D. DILLER

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U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CENTRAL STATES FOREST EXPERIMENT STATION
COLUMBUS, OHIO

Technical Note 21 September 15, 1940

EFFECT OF INTENSITY OF PRUNING ON SPROUT FORMATION IN YOUNG PLANTED PITCH PINE

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By
Thomas F. McLintock, Junior Forester,
Civilian Conservation Corps

A disadvantage associated with pruning of pitch pine trees (Pinus rigida Mill.) is the formation of sprouts on the pruned portion of the stem. Such sprouts are potential branches, and their growth defeats the purpose of pruning. The intensity of pruning has been thought to bear directly upon the amount of sprouting, and an investigation into the character of this relation was instituted in conjunction with a study of pruning as it affects height and diameter growth of pitch pine.

This joint study was initiated in 1939 on a pitch pine plantation at the Southern Illinois Branch of the Central States Forest Experiment Station. The plantation consisted of three strips totaling 1.5 acres and had been planted in 1935 to 1-1 stock. At the time of pruning the trees averaged 6.2 feet in height, 1.31 inches in diameter at breast height.

In early spring four degrees of pruning were assigned at random, each to about 50 trees on each strip. The pruning classes, as set up for the pruning experiment were as follows: (1) No pruning, i.e. left as check; (2) light pruning, only lower branches up to about 1.5 feet removed; (3) moderate pruning, to an average height of 2.75 feet, or slightly less than half the crown removed; (4) heavy pruning, two-thirds to three-quarters of the crown to an average height of 3.8 feet removed.

At the end of the growing season it was observed that, while sprouting was dense on heavily pruned trees, lightly pruned trees had relatively few sprouts per unit length of pruned stem. In order to examine the relation of sprout density to severity of pruning, sprouts on all lightly, moderately, and heavily pruned trees were counted, removed with pruning shears, and length measured in twentieths-feet. For each tree,

number and total length of sprouts, along with the height to which the tree had been pruned, were recorded. These figures were summarized for each strip or replicate, and for each of the three pruning classes. Total number and total length of sprouts were reduced to a per-foot-of-pruned-stem basis by dividing in each case by the total length of pruned stem, thus providing a uniform basis for comparison. Mean length of individual sprouts was calculated by the ratio of total number of sprouts over total length. A summary of these data is presented in table 1.

Table 1. Number and total length of sprouts per-foot-of-pruned-stem, and mean sprout length for three degrees of pruning.

Degree of pruning	Sprouts per foot pruned stem	Total sprout length per foot pruned stem	Mean individual sprout-length
	Number	Feet	Feet
Light	0.8	0.10	0.13
Moderate	1.6	0.29	0.18
Heavy	4.0	1.36	0.34

The data were subjected to analyses of variance and in each of the three tests of sprouting density a high significance appeared between pruning intensities. In table 2 are presented the minimum mean differences attaining significance and high significance.

Table 2. Minimum mean differences attaining levels of significance for number, total length and mean length of sprouts.

Significance		Sprouts per foot pruned stem	Total sprout length per foot pruned stem	Mean individual sprout-length
Degree	Level			
	Percent	Number	Feet	Feet
Significant	5	0.6	0.14	0.07
Highly "	1	1.0	0.23	0.12

Examination of means for number and total length of sprouts per foot of pruned stem revealed that the values for heavily pruned trees were highly significantly greater than those for either of the other two pruning levels. Differences between moderately and lightly pruned trees were significant in both cases. Average individual sprout length was highly significantly greater in the case of heavily pruned trees than for moderately and lightly pruned trees, but between the latter pruning levels there was no real difference.

These variations in amount of sprouting are of far greater magnitude than the corresponding differences in pruning intensity which induced them. With light pruning, i.e. removal of about one-quarter of the crown, relatively few short sprouts developed. Moderate pruning, removal of roughly one-half the crown, doubled the number of sprouts (per-foot-of-pruned-stem, not total) and tripled their collective length. By removing two-thirds to three-fourths of the crown, the number of sprouts became five times as great, their individual length two and one-half times and their aggregate length fourteen times as great as those induced by light pruning.

The development of stem sprouts consequent to pruning is an undesirable condition since, while pruning may improve wood quality, the presence and continued growth of sprouts constitute as great an eventual detriment as does the persistence of regular branches. The physiological implications, suggesting stimulation of dormant buds by sudden exposure to light, or upsetting the hormonal relations, are of practical, as well as purely scientific interest, and are being investigated by this Station.

SUMMARY

Three intensities of pruning, removing approximately one-quarter, one-half and three-quarters of the crown, when applied to six-year-old planted pitch pine in southern Illinois, induced sprout development on the pruned portion of the stem. The magnitude of this effect was directly contingent upon the relative severity of pruning. On the basis of mean length and number of sprouts per tree, per-foot-of-pruned-stem (all calculations thus being placed on a comparable level) differences between pruning treatments were highly significant, sprout formation on heavily pruned trees being up to fourteen times as dense as on lightly pruned trees.

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Ohio Agricultural Experiment Station,
OHIO DIVISION OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service,
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 22 December 1, 1940

LOCAL VOLUME TABLE 1/

for

YELLOW POPLAR

(Liriodendron tulipifera)

in Hamilton County, Ohio

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INTERNATIONAL Rule (1/2" Kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
10	20	16	1	25	678	43	3
11	43	23	-	26	748	43	2
12	72	28	2	27	825	43	2
13	105	32	3	28	915	43	2
14	142	34.5	2	29	1012	43.5	-
15	180	36.5	6	30	1125	43.5	2
16	230	38	3	31	1245	43.5	1
17	263	39.5	5	32	1380	43.5	2
18	308	40.5	4	33	1523	43.5	-
19	353	41	9	34	1655	44	1
20	400	41.5	6	35	1800	44	-
21	447	42	8	36	1948	44	1
22	498	42.5	8				
23	550	42.5	2				
24	612	42.5	6				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12.3-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 81 trees.

Table prepared, in 1940, by curving volume of merchantable length over d.b.h.

Aggregate difference: Table is 0.408% low. Average percentage deviation of basic data from table, 15.9%.

O. D. Diller
L. F. Kellogg

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CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note
No. 23

December 15, 1940

EFFECTS OF GROUND PREPARATION ON SURVIVAL AND GROWTH OF PLANTED PINE AND BLACK LOCUST

By

Thomas F. McLintock, Junior Forester
Civilian Conservation Corps

Ground preparation prior to planting has been thought to offer possibility of greater success in reforesting old fields in the Central States. The compaction of soils or the formation of a sod or a heavy herbaceous cover on old fields following their withdrawal from agricultural use seriously interferes with survival and growth of planted trees. Plowing or furrowing eliminates these conditions, thus bringing about better soil aeration and soil moisture conservation.

In 1935 a study was set up at the southern Illinois branch of the Central States Forest Experiment Station, on land recently acquired by the Government, to test the effect of plowing and furrowing in abandoned old fields on the establishment of subsequently planted pitch pine (Pinus rigida), shortleaf pine (P. echinata), and black locust (Robinia pseudoacacia). The sites selected had been abandoned for several years, and a cover of grass and herbs had become established. The soil (tentatively identified as Ava silt loam) was a friable, brownish-yellow silt loam, with a slightly compact silty clay loam subsoil, underlain by a blue St. Louis limestone. An area of 0.8 acre was selected for shortleaf pine, one of 1.5 acres for pitch pine, and two of 0.9 and 2.2 acres (designated as field plots 3 and 5, respectively) for black locust. Each area was divided roughly into three strips of which one was plowed and one furrowed, both to a depth of 6 inches, and one was left untreated as a check. These areas were planted in March 1935, with 1-1 pitch pine, 1-0 shortleaf pine, and 1-0 black locust.

In 1937 a series of plantings was made in Hocking County, Ohio, designed primarily for study of relative survival and growth of 1-0 and 1-1 stock of pitch pine and of shortleaf pine. Two comparable old-field sites were used, the soil of which was a Muskingum stony loam. On each site two plots were laid out, of which one was plowed as a preliminary to planting and the other was given no preparation. The four classes of stock were assigned randomly to 4-row sampling units on each plot. Although intended primarily for comparison of results with trees of different species and ages, the experiment was so designed that variation in survival and growth resulting from plowing could be segregated and evaluated.

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In the southern Illinois planting survival counts were made and the heights of about 200 trees were measured on each strip of pitch pine and shortleaf pine in the fall of 1939, after five growing seasons. In the black locust plantings, height measurements were taken at that time on all trees. Summaries of the data are presented in table 1. Mortality of black locust was abnormal because of heavy rabbit injury. Mean heights of black locust are presented in table 2.

Table 1.--Five-year mean mortality and height increment of pitch and shortleaf pines on southern Illinois areas

Species and ground preparation	Mortality	Height increment	Standard error of mean of height increment
	Percent	Feet	Feet
Pitch pine			
Plowing	3.9	8.31	0.07
Furrowing	7.4	8.21	.08
None	4.1	8.07	.08
Shortleaf pine			
Plowing	12.6	8.52	.10
Furrowing	14.3	7.69	.15
None	18.3	7.90	.12

Table 2.--Five-year mean height increment of black locust on southern Illinois areas

Plot and ground preparation	Height increment	Standard error of mean
	Feet	Feet
Plot 3		
Plowing	9.69	0.21
Furrowing	9.09	.18
None	8.38	.24
Plot 5		
Plowing	14.70	.24
Furrowing	10.60	.24
None	11.63	.28

In the Hocking County plantings, heights of all trees were measured and yearly increments calculated at the end of each growing season. Mean height-increment values for the first 3 years are typical, and are presented for four classes of stock on plowed and unprepared ground in table 3. Mortality differences were slight.

Table 3.--Three-year height increment of two classes of pitch and shortleaf pine stock on areas in Hocking County, Ohio

Ground preparation	Height increment, by species and class of stock			
	Pitch pine		Shortleaf pine	
	1-0	2-0	1-0	2-0
	Feet	Feet	Feet	Feet
Plowing	2.29	2.66	2.64	2.51
None	1.72	2.14	2.32	1.92

Five-year height growth of the pines planted in southern Illinois in 1935, which differed very little by species, was consistently better on plowed than on unprepared ground. For pitch pine, the advantage in growth associated with plowing amounted to 0.24 foot, a statistically significant difference. Growth on furrowed strips was superior to that on untreated and inferior to that on plowed strips, but the differences were not significant. Five-year height growth of shortleaf pine was greater on plowed ground than on furrowed and untreated ground by the highly significant mean differences of 0.83 and 0.62 foot, respectively. Mortality figures were somewhat inconsistent, but trees of both species survived best on plowed ground. The shortleaf pine mortality of 18.3 percent on the untreated strip was noticeably higher than that on either of the treated strips. Furrowing led to greater mortality of pitch pine. This effect, and also the deficiency in height growth of shortleaf pine on furrowed ground, arose from silting in the furrows after heavy rains. It is quite possible that damage from silting in furrows could be largely eliminated by reducing furrow depth. Differences among plantings of the same year were more clear-cut for black locust than for pine. Five-year height increment of black locust was greater on the two plowed strips than on the corresponding untreated strips by 1.31 and 3.12 feet, respectively. On plot 3 growth was greater on the furrowed strip than on the check strip, but on plot 5, apparently because of some silting injury, it was less on the furrowed strip than on the check strip.

Trees in the Hocking County pine planting, having passed through but three growing seasons, did not show so much variation in height growth as did those planted in southern Illinois. The differences in the two experiments were consistent in that growth of trees on plowed land invariably exceeded that on untreated land, and were highly significant. The greatest difference, 0.59 foot, appeared in growth of shortleaf pine 2-0 stock; the least, 0.32 foot, in growth of shortleaf pine 1-0 stock.

On the basis of these experiments it seems too early to recommend ground preparation as a means for increasing survival and height growth of the species studied in general reforestation programs. While on abandoned old fields with certain soil types it has been found that the advantage occasioned by plowing persists to the end of the fifth growing season, height differences are generally small and the slight dominance of trees on plowed ground may disappear as the trees mature. Differences in mortality are insignificant and not commensurate with the cost of ground preparation. The results indicate, however, that plowing does have a beneficial effect, especially on black locust, and on more severe sites may mean the difference between success and failure of a plantation. Ground preparation, though seldom feasible in connection with ordinary field planting, is probably justified in the case of certain critical areas on which the establishment of a forest cover is imperative but on which--by reason of soil or vegetation difficulties--tree seedlings will not survive and grow without it. At any rate, it is safe to say that further investigation on more severe sites and with other species is warranted.

3011
A524

Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 24 January 1, 1941

LOCAL VOLUME TABLE[1]

for

YELLOW POPLAR

(Liriodendron tulipifera)
in Holmes County, Ohio

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
7	5	14.5	1				
8	20	22	5				
9	38	27.5	4				
10	58	32	4	25	830	68.5	6
11	79	36	4	26	930	70	8
12	105	39.5	4	27	1025	71.5	4
13	130	43	4	28	1120	72.5	5
14	159	46	5	29	1220	74	8
15	190	48.5	2	30	1330	75	6
16	225	51	1	31	1430	76	2
17	268	53.5	5	32	1535	77	6
18	315	56	1	33	1645	78	4
19	370	58	2	34	1750	79	2
20	425	60	4	35	1860	80	2
21	490	62	5	36	1970	81	1
22	570	63.5	4	37	2090	82	-
23	6535	65	5	38	2200	83	1
24	740	67	3	39	2315	83.5	-

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12.3-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 118 trees.

Table prepared, in 1940, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.22% low. Average percentage deviation of basic data from table, 12.3%.

J. Richard Crawmer
L. F. Kellogg

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 25 January 15, 1941

LOCAL VOLUME TABLE[1/]

for

EASTERN WHITE PINE

(Pinus strobus)
in Holmes County, Ohio
INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
7	3	12.5	4
8	17	18	3
9	34	27	5
10	50	34.5	6
11	71	39.5	7
12	94	44	5
13	122	48	6
14	151	51.5	5
15	185	54.5	5
16	222	57	7
17	259	59.5	5
18	299	62	4
19	340	64	6
20	381	65.5	4
21	424	66.5	8
22	468	67.5	5
23	514	68	5
24	562	68.5	3
25	611	69	1
26	662	69	1
27	714	69	-
28	769	69	1

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 96 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.51% low. Average percentage deviation of basic data from table, 14.3%.

J. Richard Crawmer
L. F. Kellogg

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 26 January 15, 1941

LOCAL VOLUME TABLE 1/
for
EASTERN HEMLOCK
(Tsuga canadensis)
in Holmes County, Ohio

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FEB 12 1968
ROCKY MOUNTAIN STATION

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
8	16	12.5	4
9	28	21	7
10	44	27	5
11	63	31.5	8
12	84	35.5	6
13	109	39.5	6
14	136	42.5	5
15	166	45.5	5
16	200	48.5	6
17	236	51	7
18	275	53.5	3
19	317	56	7
20	362	58	6
21	410	60	4
22	461	62	5
23	515	63	3
24	572	65	2
25	632	66	3
26	695	67	2
27	760	68	-
28	829	69	1
29	900	70	-
30	975	70.5	-
31	1,052	71.5	2

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 97 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.38% high. Average percentage deviation of basic data from table, 15.0%.

J. Richard Crawmer
L. F. Kellogg

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 27 January 15, 1941

LOCAL VOLUME TABLE [1]

for

WHITE OAK

(Quercus alba)
in Franklin County, Ohio

INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
				30	835	45	1
6	-	-	2	31	903	45.5	1
7	5	19	1	32	974	46	2
8	11	20.5	1	33	1050	46.5	1
9	20	22.5	1	34	1125	47	1
10	32	24	4	35	1202	47.5	2
11	44	25.5	3	36	1286	47.5	2
12	64	27	2	37	1368	48	-
13	88	28.5	4	38	1458	48	2
14	106	29.5	3	39	1550	48.5	-
15	135	31	4	40	1640	48.5	-
16	160	32.5	3	41	1738	48.5	-
17	193	33.5	6	42	1834	48.5	1
18	224	35	4	43	1930	49	1
19	261	36	6	44	2038	49	-
20	299	37	1	45	2140	49	-
21	340	38	3	46	2253	49	-
22	384	39	3	47	2360	49	1
23	435	40	2	48	2479	49	-
24	481	41	4	49	2590	49	-
25	535	41.5	1	50	2716	49	-
26	588	42.5	2	51	2833	49	1
27	645	43	3	52	2963	49	-
28	706	44	4				
29	770	44.5	2				

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height for trees up to 29.9 inches d.b.h., and above a 1.5-foot stump for trees 30.0 inches and over in d.b.h. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 85 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.53% high. Average percentage deviation of basic data from table, 20.6%.

W. O. Schramm
L. F. Kellogg

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U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CENTRAL STATES FOREST EXPERIMENT STATION
COLUMBUS, OHIO

Technical Note 28 February 15, 1941

EFFECT OF SCREEN PROTECTION ON FIRST-SEASON GROWTH OF YELLOW POPLAR PLANTED IN AN OLD FIELD

by

W. H. Cummings

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FEB 12 1968
ROCKY MOUNTAIN STATION

Plantings of yellow poplar are difficult to establish on many old field sites in southern Ohio. Particularly those seedlings planted on bare, exposed spots evidence very poor height growth if they survive at all. Thrifty natural reproduction generally occurs on spots that are somewhat protected from air movement and intense sunshine. Whether height growth of yellow poplar seedlings planted in an open field can be markedly increased by setting screen enclosures about individual trees is a question now under test in a small field experiment. The experiment is located in a mixed planting of yellow poplar and black walnut on a lower easterly old-field slope with a cover of grass and weeds near Longstreth, Hocking County, Ohio. Forty-five yellow poplars were selected for treatment in the spring of 1940, a few weeks after planting.

Four types of open-top screen enclosures are being used, namely, 1-foot and 1½-foot cylinders 5.6 inches in diameter, and 1-foot and 1½-foot cone frustums 3.7 inches in diameter at the ground and 7.5 inches across the top. The required sections were cut from a roll of 12-mesh black enameled screening 3 feet wide, rolled into form, and stapled along edges overlapped ½ inch. Nine screen forms of each type and 9 unscreened checks were assigned completely at random to the 45 yellow poplars. The screen forms were tacked along the line of stapling to stakes 1½ or 2 feet long. Stakes were set on the west side of trees to a depth of ½ foot, bringing the encircling screen flush with the ground. Unscreened check trees also were staked.

Examination of the yellow poplar screening experiment in the fall of 1940 showed that all 45 trees had survived the first field growing season. Height increment of the nine trees subjected to each treatment averaged as follows:

Type of screen enclosure	Height increment in first field season
	Feet
Cylinder 1½ feet high	0.49
Cone frustrum 1½ feet high	.40
Cylinder 1 foot high	.36
Cone frustum 1 foot high	.31
Unscreened, check	.14

The average height growth of yellow poplar trees in the 1½-foot cylinder was over 3½ times that of check trees, and that of trees in the 1½-foot cone frustum was almost 3 times that of check trees. The notable increase in height growth of yellow poplar in the 1½-foot enclosures is attributed to protection by the screen.

The screen used reduces the intensity of light striking at right angles by about 29 percent; however, the open-topped forms afford scant protection against the intense sunshine when the sun is at higher altitudes. Protection by the screen forms against air movement and moisture loss is probably of considerable importance. During the first year or two such screens greatly reduce the risk of damage by rodents or fires.

Bought retail in a small roll, the screening in each 1-foot form cost 3.4 cents and that in each 1½-foot form cost 5.1 cents. Considerable labor was entailed in making up the screen forms and setting them about the planted seedlings. If screen enclosures assure vigorous initial growth and better survival of yellow poplar, the density of planting might be drastically reduced so that on an acre planted the cost of screen procured in quantity might not be prohibitive.

Yellow poplar enclosed in 1½-foot screen forms evidenced more vigorous initial height growth than seedlings not afforded this protection. The beneficial effect recognized in this small experiment is in accordance with observations that screening protection by vegetation such as sassafras, black locust or broom sedge -- if not too dense -- favors the initial growth and the establishment of yellow poplar planted or naturally seeded on old fields.

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 29 1/ April 1, 1941

LOCAL VOLUME TABLE
for
WHITE OAK
(Quercus alba)
in Holmes County, Ohio

INTERNATIONAL Rule (¼" kerf)

Merchantable Stem to a Variable Top Diameter

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

Diameter breast high outside bark (Inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
7	1	16	2
8	8	19.5	6
9	20	23	1
10	36	26	3
11	56	29	5
12	79	31.5	4
13	107	34.5	7
14	138	37	4
15	174	39.5	3
16	213	42	4
17	257	44.5	1
18	304	46.5	3
19	355	48	3
20	412	50	1
21	470	52	6
22	537	53.5	1
23	600	55	3
24	678	56.5	7
25	747	58	1
26	825	59	5
27	909	60	4
28	995	61	1
29	1087	62	4
30	1185	62.5	2
31	1280	63	3
32	1381	63.5	2
33	1490	64	3
34	1600	64	5
35	1715	64	4
36	1830	64	6
37	1957	64	6
38	2080	64	5
39	2214	64	3
40	2344	64	1
41	2486	64	-
42	2630	64	3
43	2775	64	1
44	2930	64	-
45	3080	64	-
46	3240	64	-
47	3400	64	-
48	3570	64	1

(1) Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166--"the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 124 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: Table is 0.34 percent low. Average percentage deviation of basic data from table, 16.5 percent.

J. Richard Crawmer
L. F. Kellogg

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 30 April 15, 1941

LOCAL VOLUME TABLE [1]

for

WHITE ASH

(Fraxinus americana)
in Franklin County, Ohio
INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

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FEB 12 1968
ROCKY MOUNTAIN STATION

Diameter breast high outside bark (inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
				20	349	41	5
			(1)	21	392	42	1
7	4	22	1	22	439	43	3
8	16	24	1	23	488	44	5
9	30	25.5	1	24	539	44.5	1
10	46	27.5	8	25	593	45.5	2
11	65	29	6	26	649	46	6
12	87	30.5	5	27	708	47	-
13	111	32	2	28	769	47.5	2
14	137	33.5	3	29	833	48	2
15	166	35	5	30	900	48.5	3
16	198	36.5	5	31	968	49	4
17	232	37.5	6	32	1040	49	-
18	268	39	3	33	1113	49.5	-
19	307	40	1	34	1190	49.5	1
				35	1268	49.5	1
				36	1350	49.5	1

[1] Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 -- "the Ohio Woodland Survey." Measurements taken at 12.3-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 85 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.07% low. Average percentage deviation of basic data from table, 21.4%.

W. O. Schramm
L. F. Kellogg

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 31

LOCAL VOLUME TABLE 1/

May 1, 1941

for

BLACK WALNUT

(Juglans nigra)
in Franklin County, Ohio

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

INTERNATIONAL RULE ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number
8	10	23	1
9	23	24	5
10	37	24.5	3
11	52	25	5
12	68	26	3
13	87	26.5	9
14	107	27	5
15	127	27.5	5
16	149	28	6
17	173	28.5	4
18	200	29	5
19	232	30	3
20	266	30.5	2
21	302	31	3
22	343	31.5	3
23	387	32	4
24	435	32.5	4
25	485	33	1
26	538	33.5	3
27	595	34	1
28	655	34.5	2
29	717	35	-
30	783	35.5	-
31	852	36	2

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 -- "the Ohio Woodland Survey." Measurements taken at 12.3-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 79 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.81% high. Average percentage deviation of basic data from table, 22.5%.

W. O. Schramm
L. F. Kellogg

S011
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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

LIBRARY
FEB 12 1968
ROCKY MOUNTAIN STATION

Technical Note
No. 32

May 1, 1941

BLACK LOCUST, PINES, AND SASSAFRAS AS BUILDERS OF FOREST SOIL

John T. Auten, Silviculturist

Soil conditions on areas selected for reforestation in the Central States are often very unfavorable. Litter-protected, porous surface soil has been broken by cultivation and removed by erosion. The compact soils thus exposed are incapable of absorbing rainfall adequate for satisfactory tree growth; also, being uninsulated and low in moisture, they have critical high temperature extremes.

The suitability of a tree species as a pioneer for reforestation under such soil conditions depends definitely on three properties: Ample leaf production, persistence of litter cover on the soil surface, and a type of litter decomposition that favors organic-matter incorporation into the mineral soil. Accumulation of a litter cover on the bare mineral soil is necessary for development of desirable forest soil porosity. Organic matter in mineral soil (in addition to constituting a reserve supply of plant nutrients) aids in effecting flocculation and formation of soil aggregates. Litter cover preserves porosity from destruction by impact of rain, and prevents clogging of the porous mass by muddy water; only filtered water enters a litter-protected forest soil. Increased soil porosity influences infiltration rate, which to a great extent determines the quantity of water stored in the soil. Without adequate soil water the productive forest is impossible.

Certain pines -- particularly shortleaf, Virginia, and pitch -- have been used extensively and successfully for planting on dry sites in the Central States. Black locust has been planted for erosion control because, although it may not develop satisfactorily later, it does persist in the early stages on some very poor sites. Sassafras has not been planted, but regenerates easily and extensively. It is considered a pest in many farming sections, because it invades cultivated fields and often spreads under tillage with great rapidity. The present investigation was designed to determine how black locust, certain pines, and sassafras compare in soil-building properties as measured by weight of litter per acre, quantity of organic matter incorporated in the mineral soil, and rate of water infiltration into the soil. The pines included in the study were shortleaf, Scots, Austrian, eastern white, and red. Nitrogen in the upper soil of locust and sassafras areas previously used for agriculture was compared with that in corresponding old-field soils, because nitrogen content of a soil is derived largely through organic-matter incorporation and affords a valuable measure of soil improvement. Calcium and nitrogen contents of the litters of black locust, pines, and sassafras also were determined, because of their influence on rates of decomposition and incorporation into the soil. In addition, a complete inventory of organic matter was made on a black locust and a nearby sassafras stand on old-field areas.

Study Areas and Sampling

The investigation was made on three areas: The Shawnee Experimental Forest, Hardin County, Ill.; the Morgan-Monroe State Forest, Ind.; and the Brown County State Park, Ind.. These areas were considered representative of the rough abandoned land in much of the unglaciated portion of the Central States. The predominating soil type of all three areas is Muskingum silt loam. Use was made of 56 wooded plots, each 20 feet square: 18 black locust, 11 pine, and 27 sassafras. These plots were selected on the basis of complete stocking and of uniformity as to litter cover and microrelief. The stands were even-aged, and represented as wide a range of ages as could be found within the study areas. With each wooded plot an adjacent nonforested old-field plot was matched.

When each 20- by 20-foot plot had been located, stakes were driven at the corners and a string stretched around them. Two numbers were drawn at random from the series 1 to 20. The first number of feet was measured from the southeast corner along the eastern border, and the second number of feet was measured from the northeast corner along the northern border. Perpendiculars were drawn from the north and east sides at the points thus located, and their point of intersection within the plot was made the southeast corner of a 1-foot-square sampling area. Another sampling area of the same size was similarly located by measurements along the west and south sides from the southwest and northwest corners, and the litter from each of the two areas was bagged. Four areas for an infiltration test were similarly located, and on these soil samples were taken from each of two horizons, the A_1 and the A_2. The corresponding soil-horizon samples from each of the two areas were mixed. This gave two A_1 and two A_2 composite samples.

Litter and Its Influence

The two samples of litter taken from each plot were dried and weighed, and their weights were corrected for adhering soil. The average corrected weights, by species and age of stands, are presented in table 1.

Table 1.--Oven-dry weight of litter per acre

Age class of stand (years)	Black locust	Pines	Sassafras
	Pounds	Pounds	Pounds
0-5	5,400	-----	5,000
6-10	8,600	1/ 3,555	5,500
11-15	8,300	1/ 17,800	6,400
16-20	12,300	-----	7,400
21-25	10,200	2/ 20,600	6,800

1/ Value not strictly comparable with those for black locust and sassafras, because based on samples taken only directly under trees.

2/ Value comparable with those for black locust and sassafras, because the crown canopy was closed and the litter cover fairly uniformly distributed.

The relative weights of litter per acre of locust, pines, and sassafras in the 21- to 25-year age group approximated 10,000, 20,000, and 7,000 pounds, respectively. The data indicate that the pines have a superior usefulness in developing protective litter cover on bare land for erosion control and site improvement.

The leaf litters of black locust, pines, and sassafras differed widely in chemical composition (table 2). Calcium and nitrogen contents of black locust

Table 2.--Average calcium and nitrogen contents of litter of black locust, pines, and sassafras

Species	Calcium	Nitrogen
	Percent	Percent
Black locust	3.22 ± 0.115	2.81 ± 0.37
Pines	.46 to 2.40	.64 to 2.66
Sassafras	1.57 ± 0.054	1.59 ± 0.053

litter were almost double those of sassafras litter. Shortleaf pine litter averaged only 0.70 percent calcium and 1.07 percent nitrogen, whereas Scots pine averaged 1.66 percent calcium (minimum 1.11 percent, maximum 2.40 percent) and 2.20 percent nitrogen. The litter composition of Scots pine would seem to favor rapid decomposition more than that of other pines, but observations on Scots pine litter do not indicate that it differs much in that respect from the litter of other pines.

The influence of the litter of these species on soil profile formation is to some degree independent of chemical composition. The predominant factors in it are (1) physical characteristics that influence desiccation and (2) palatability. Because of its relatively high calcium and nitrogen content, the litter of black locust presumably would decompose and become incorporated in the mineral soil as rapidly as that of sassafras,[1/] except that it dries out more quickly and does not make so intimate a contact with the mineral soil, and thus is not so readily eaten by soil fauna. Possibly, also, it is not so palatable as the other litters. Pine litter, likewise, lies loosely and because of its lightness dries out quickly.

Partly because of this looseness of the litter, and still more because of liberation of nitrogen from decomposed nodules and litter, luxuriant growth of grass and weeds is very common under black locust; under sassafras or pines, such growth is rare or nonexistent. If a young natural stand of black locust is very dense, with closed crown canopy, grass will be absent for a period of years; when the stand becomes less dense through natural thinning, however, grass will

1/ Gast, P. R. Contrast Between the Soil Profiles Developed under Pines and Hardwoods. Jour. Forestry 35 : 11 - 16. 1937

Broadfoot, W. M., and Pierre, W. H. Forest Soil Studies: I. Relation of Rate of Decomposition of Tree Leaves to Their Acid-Base Balance and other Chemical Properties. Soil Sci. 48 : 329 - 348. 1939.

occupy the forest floor. If pasturing is practiced at the latter stage, tree reproduction is inhibited and a grass sod is likely to form. Grass sod makes it difficult for trees of other species to develop under the locust.

Incorporated Organic Matter

Darkening of the soil by organic matter in most cases did not extend below 2 inches. By subtracting loss on ignition of the A_2 horizon (usually the 4- to 6-inch zone) from that of the A_1 horizon (the 0- to 2-inch zone), the superiority of the latter in organic matter was estimated. Igniting a soil not only removes volatile and combustible material but also drives off any chemically combined water held by the minerals; hence, to estimate organic-matter content of soil it is necessary to correct simple loss on ignition for loss of combined water. It was assumed that, because of cultivation, the soil of the A_1 and A_2 horizons had been fairly homogeneous as to combined water at the time when the study areas were abandoned for agriculture, and had remained so. Thus, when the ignition loss of an oven-dry A_2 soil sample was subtracted from that of an oven-dry A_1 sample, it was considered that the losses of combined water had been equal and that the remainder represented only volatile and combustible organic matter added to the A_1 soil horizon by organic debris since time of abandonment. This difference offers a means of comparing the soil-building properties of woods and field vegetation. The results of such comparison for black locust, pine, and sassafras plots are presented in table 3.

Table 3.--Difference between woods and adjacent old-field soil in organic matter added to A_1 horizon since land abandonment, in pounds per 500,000,1/ for black locust, pines, and sassafras

Black locust	Pines	Sassafras
Pounds	Pounds	Pounds
+ 8,300	- 1,750	+ 450
- 3,400	- 2,500	+ 7,650
+ 3,750	- 8,000	+ 500
- 2,200	- 6,050	+ 2,400
+ 4,050	- 4,800	+ 800
- 3,450	- 2,200	+ 2,950
- 4,050	+ 8,900	+ 4,200
0	+ 7,750	+ 9,300
- 2,800	+ 1,700	+ 950
+ 4,450	+ 3,700	+ 4,200
- 3,450	- 700	+ 500
+ 1,450		+ 1,850
+ 3,000		+ 1,600
- 700		+ 7,400
- 1,350		+ 1,250
+ 4,050		+ 1,450
		+ 3,150
		+ 600
		+ 3,600

1/ This ratio was chosen because 500,000 pounds is the approximate weight of a 2-inch layer of soil covering an acre, as determined by sampling.

The significant point in this comparison is that all sassafras woods soils showed positive superiority in organic-matter accumulation over the corresponding field soils. In 8 out of 15 locust woods soils, organic-matter content was less than in the corresponding field soils. Similarly, out of 11 pine woods soils 7 had less organic matter than the corresponding field soils. Evidently sassafras had proved superior to locust and pine as a contributor of humus to the mineral soil.

Nitrogen in Mineral Soil

Accumulation of nitrogenous substances in the upper mineral soil is one of the indexes of fertility. Any differences in nitrogen content between the A_1 and A_2 soil horizons on the study areas was attributed to accumulation since abandonment, and superiority of any soil in nitrogen content may be attributed to character of vegetative cover. Nitrogen accretion was assumed to be confined to the A_1 soil horizon, because any nitrogen mobilized from organic matter would have been removed by leaching. Table 4 presents a series of values for black locust

Table 4.--Difference between woods and adjacent old-field soil in nitrogen added to A_1 horizon since land abandonment, in pounds per 500,000, for black locust and sassafras

Black locust	Sassafras
Pounds	Pounds
+ 343	- 32
- 46	+ 330
+ 133	- 85
+ 41	+ 48
+ 259	+ 180
- 357	+ 44
- 91	+ 228
- 146	+ 325
- 189	
+ 413	
- 50	
- 26	
+ 172	
+ 64	
- 31	
+ 148	

and sassafras plots derived by subtracting the nitrogen weight of the A_1 horizon of a field plot from that of its paired woods plot. Such values were not calculated for pine plots because the pines are known not to be nitrogen fixers; furthermore, nitrogen-containing organic matter does not become incorporated in pine soil under normal conditions, and any nitrate nitrogen liberated from surface debris is soon lost by leaching.

The important point brought out by table 4 is the low nitrogen content of the black locust soil. It is well known that black locust litter is high in protein, but apparently its nitrogen does not get into the mineral soil in a form or

amount permitting accumulation. Abundant nodules occur generally on black locust roots, and they are known to be high in nitrogen; but apparently sassafras, although not a legume, had caused as much nitrogen accumulation in the soil as locust. When actual volume of root nodules is compared with soil volume this does not seem strange, especially as the nodule protein is easily nitrified. That much nitrogen is fixed by black locust cannot be doubted, but probably it is quickly absorbed by plant roots or lost by leaching. This rapidly evolved nitrate nitrogen might well be utilized by trees of more valuable species planted with the locust.

Complete Organic Matter Inventory

The changes in litter from the time it accumulates until it becomes incorporated in the mineral soil are well illustrated by data collected in midsummer on two additional 20-by-20-foot plots in an old-field stand of black locust and a nearby old-field stand of sassafras. The stands were aged 9 and 12 years, respectively. All trees on the two plots were cut, and their leaves plucked. Litter was collected down to the mineral soil, and the A_1 and A_2 soil horizons were sampled. Oven-dry weight of organic matter was determined on leaves, litter, and soil, and in addition the live annuals were collected and weighed separately. The results are shown graphically in figure 1. Leaf weights were about equal, organic matter of live annuals and dead material was greater on the locust than on the sassafras area, and organic-matter incorporation was much greater in the sassafras soil. These data agree with those collected from the other sample plots in showing that more organic debris collects on an area covered with black locust than on one covered with sassafras, but that a great deal more organic matter enters the sassafras soil than enters the black locust soil.

Infiltration Rate

One of the most significant evidences of improvement in a denuded, impoverished soil is increase in the rate at which the soil absorbs rainfall. Infiltration rate is controlled by soil porosity; hence as the soil mellows its infiltration rate increases. In this study, infiltration rate was determined by means of a 1-foot-square sheet-iron frame slotted parallel to one edge and supplied with a trough. The frame was sunk into the soil, with the slot parallel to and at the soil surface. A 1-foot-square pan perforated with 100 pinholes was set over the top of the frame, and through this water was poured. As the water dropped onto the soil, part of it was absorbed and the remainder ran off, passed through the slot and down the trough, and was caught in a cylinder placed in a soil pit alongside the absorption frame. Water was sprinkled by this method onto 4-foot squares in each woods plot and in each field plot at the rate of 1 liter each 5 minutes (5 inches per hour). When the rates of run-off remained the same for two consecutive applications, infiltration was considered constant and recorded as such. Averages were taken of each group of four tests made on woods and field plots.

The relative infiltration rates are presented in table 5 and figure 2. It may be seen that the black locust woods soil differed little in this respect from the corresponding field soil; the differences are not statistically significant. The rate of infiltration under sassafras, however, increased with age of stand, while that on the corresponding field plots remained essentially the same. Here the differences are statistically significant.

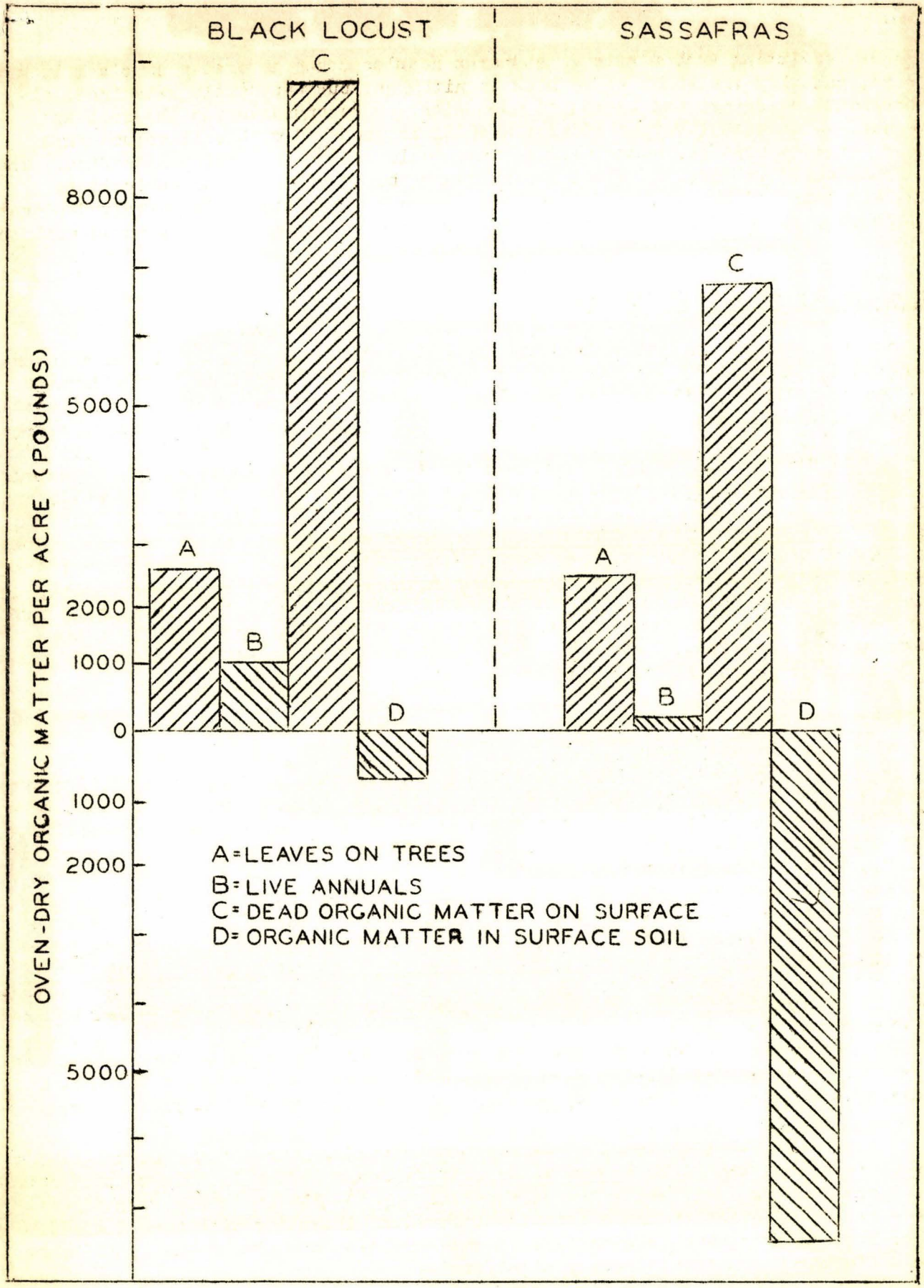

Figure 1.--Quantity and distribution of organic matter produced by trees and lesser vegetation on old-field areas forested with black locust and sassafras, respectively.

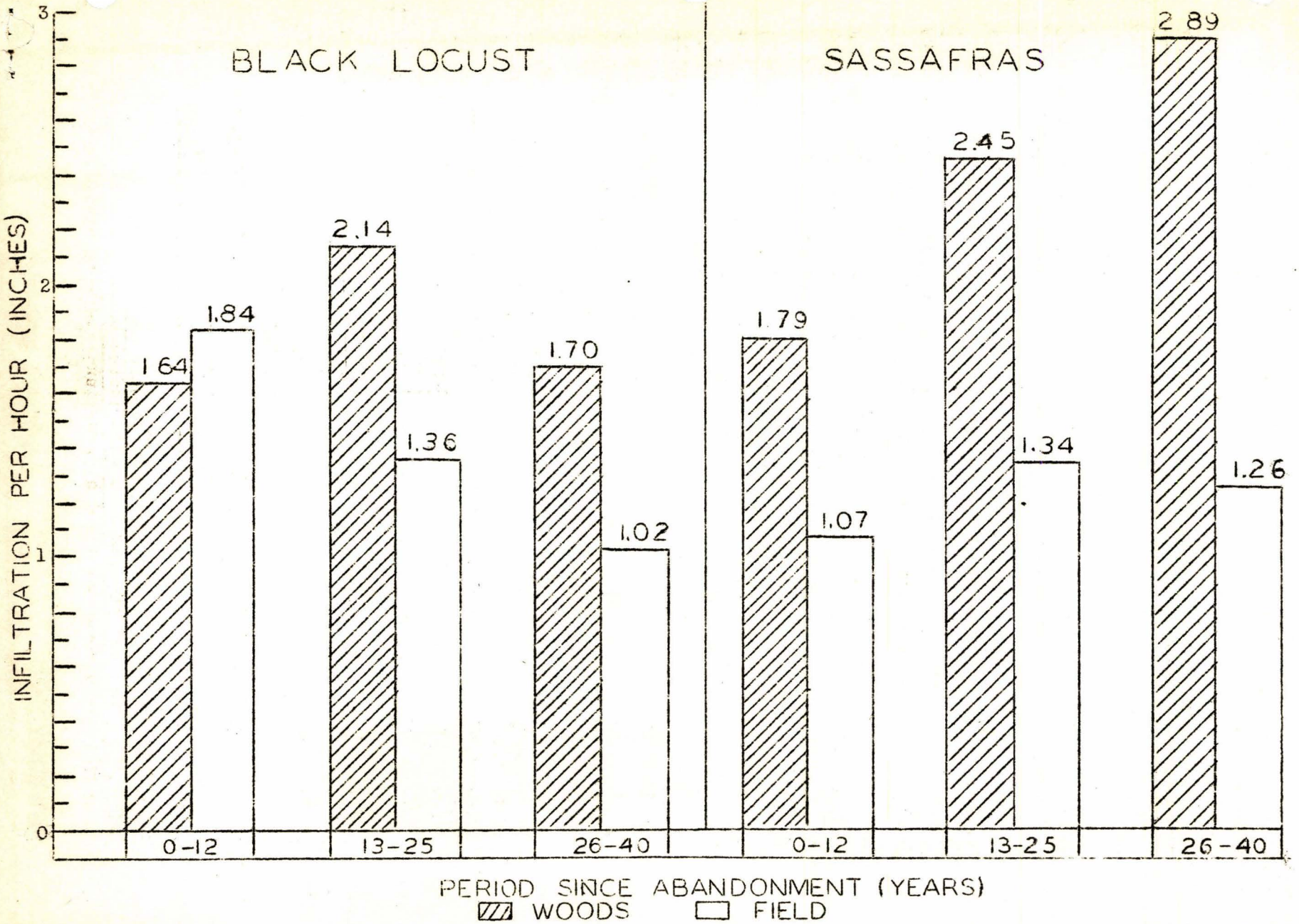

Figure 2. -- Infiltration rates of soils in old fields and under old-field stands of black locust and sassafras.

Table 5.--Infiltration rate per hour under black locust and sassafras and on matched old-field plots,1/ when rate of application was 5.08 inches per hour

Age (years)	Black locust		Sassafras	
	Woods	Field	Woods	Field
	Inches	Inches	Inches	Inches
0-10	1.64 ± 0.41	1.84 ± 0.17	1.79 ± 0.20	1.07 ± 0.18
11-20	2.14 ± 0.24	1.36 ± 0.19	2.45 ± 0.24	1.34 ± 0.20
21-40	1.70 ± 0.23	1.02 ± 0.13	2.89 ± 0.27	1.26 ± 0.19
All	1.83 ± 0.13	1.41 ± 0.10	2.38 ± 0.14	1.22 ± 0.10

1/ Each figure with its standard error is a mean of 24 determinations for black locust and matched field plots and of 36 determinations for sassafras and matched field plots.

This test was restricted to black locust and sassafras because the effectiveness of pines in increasing infiltration rates in old-field soils had been fully established in earlier investigations. 2/

Summary

Black locust, pines (shortleaf, Scots, Austrian, eastern white, and red), and sassafras have been considered as pioneer crops on bare land for forest soil building in the Central States.

Pines were found to rank first in abundance of litter produced, black locust next, and sassafras last. Sassafras litter had become incorporated in the mineral soil to a greater degree than either black locust or pine litter.

Although not a legume, sassafras had caused as great accumulation of total nitrogen in the upper mineral soil as black locust.

Black locust plantings are likely to cause grass to develop on the forest floor, unless they are underplanted with other tree species.

Sassafras proved superior to black locust in causing an increase in infiltration rates of rainfall.

2/ Auten, John T. Porosity and Water Absorption of Forest Soils. Jour. Agr. Research 46: 997 - 1014. 1933.

_____ The Effect of Forest Burning and Pasturing in the Ozarks on the Water Absorption of Forest Soils. Central States Forest Expt. Sta. Tech. Note 16. 1934.

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Ohio Agricultural Experiment Station
DEPARTMENT OF FORESTRY
In Cooperation With
U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 33 May 1, 1941

LOCAL VOLUME TABLE 1/

for

RED OAK

(Quercus borealis)
in Holmes County, Ohio

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INTERNATIONAL Rule ($\frac{1}{4}$" kerf)

Merchantable Stem to a Variable Top Diameter

Diameter breast high outside bark (inches)	Volume per tree	Average merchantable length	Basis in trees	Diameter breast high outside bark (inches)	Volume per tree	Average merchantable length	Basis in trees
	Board feet	Feet	Number		Board feet	Feet	Number
7	7	10.5	1				
8	19	18.5	2				
9	35	24.5	1				
10	58	29.5	2	25	7710	60	3
11	80	33.5	4	26	780	61	2
12	103	36.5	3	27	853	61.5	4
13	130	39.5	6	28	929	62	4
14	160	42	5	29	1009	62	-
15	194	44.5	3	30	1092	62.5	4
16	231	46.5	1	31	1178	62.5	2
17	271	48.5	3	32	1267	62.5	7
18	314	50.5	2	33	1360	63	2
19	361	52.5	2	34	1456	63	3
20	411	54	1	35	1556	63	3
21	464	55.5	5	36	1659	63	3
22	520	57	4	37	1765	63	1
23	580	58	5	38	1874	63	2
24	643	59	4	39	1987	63	1

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12.3-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Basis, 95 trees.

Table prepared, in 1941, by curving volume of merchantable length over d.b.h.

Aggregate difference: table is 0.20% low. Average percentage deviation of basic data from table, 13.5%.

J. Richard Crawmer
L. F. Kellogg

INTERMOUNTAIN STATION
Central Reference File
No. 0.73

U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note 34 July 15, 1941

FOREST SOIL PROPERTIES ASSOCIATED WITH CONTINUOUS OAK, OLD-FIELD PINE, AND ABANDONED FIELD COVER IN VINTON COUNTY, OHIO

By

John T. Auten, Silviculturist

Deterioration of cleared land by erosion of surface soil has been recorded in diminishing crop returns and land abandonment. Destruction of litter and forest soil structure, soil compaction, and critical reduction in rate of water absorption have made regeneration of hardwoods difficult on many abandoned areas.

Regeneration of hardwood forests is coincident with and dependent on rebuilding the forest soil. The degree to which a litter cover is restored, cessation of erosion, increase in water absorption, and amelioration and enrichment of the surface soil with humus are of interest as evidences of soil recovery. This paper deals with such indications of soil building as they were determined on an area in Vinton County, Ohio.

A resident who had lived nearby for nearly 80 years observed the area through the entire process of clearing, farming, abandonment, and regeneration to pine. He had harvested wheat, thinned a young stand of pine and later cut logs off the same area. He said when the pine seedlings produced by natural seeding from 3 or 4 old trees were 4 or 5 feet high one could stand almost anywhere among them and touch several at once. At present there are about 250 pine stems per acre with an understory of native hardwoods coming in under the mature pines. Healed gullies are still evident in the shortleaf pine area, indicating destructive erosion after abandonment. The crown canopy is completely closed.

Adjacent to the shortleaf pine stand was an old field recently abandoned and covered with weeds. Since the two areas have the same or very similar soil types and since the histories of their uses have been so nearly alike except that one was forested, they offered opportunity for comparison regarding soil conditions.

Nearby was a stand of second-growth chestnut oak. Cutting has been consistently practiced in this stand as the trees grew large enough for cross ties. Fires have been recurrent as evidenced by scars, but at the time it was examined the area had not been burned for at least 4 or 5 years. Accumulated litter was intact for that period except for normal decomposition. The crown

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canopy was about 80 percent closed. The soil had not been disturbed except for diminution of total organic matter added in the litters of previous years. The site is a little higher than the old field and the shortleaf pine stand. The soil is the same except it contains a little more sand than that of the old field and the shortleaf pine areas.

A second-growth white oak stand with history comparable to that of the chestnut oak was used as a further basis of comparison. It occurs on the same type of soil as that supporting the shortleaf pine. The stand was not quite so complete as that of the chestnut oak but still fair. The crown canopy was about 60 percent closed. Cutting has probably been a little more severe because of the more desirable quality of the timber.

These four sites together with a second abandoned field used for additional porosity and water infiltration data form the basis of this study. The results secured are comparative in nature. No data are available on the soil of any of the sites in their original state. That the sites are located in the same area, have similar histories and are representative of the condition of a great deal of land in eastern Ohio lends value to the comparisons made.

Recovery from erosion on cleared areas in this region was probably more rapid than it has been in some others. Tillage was continued until farming became unprofitable as elsewhere, but regeneration of forests has been easier. The soils are principally Muskingum and Wellston silt loams, with the Muskingum series predominating. The Muskingum is a loose, well-drained soil without a very pronounced B or subsoil horizon. The Wellston has a subsoil but its drainage is good. These soils erode easily and removal of the entire A horizon is common on steep slopes, but when the surface soil is gone a porous subsoil is exposed. An eroded Muskingum soil retains much of its soil porosity, hence forest rehabilitation has accordingly followed abandonment with greater success.

Table 1 gives stem numbers and total basal area for shortleaf pine, chestnut oak and white oak plots. The only record available regarding timber taken off the area was the owner's statement that he had cut 4 carloads of logs off the 20-acre shortleaf pine tract. The total basal area of the pine stand exceeds that of the chestnut oak. The white oak stand has about 50 percent as great a basal area. It is interesting to observe that hickory forms a large part of the hardwoods which have regenerated under pine. One yellow poplar has entered the dominant stand. The cycle from hardwoods, through cultivation and abandonment, to regeneration of hardwoods is almost complete.

Litter

The quantity of litter accumulated under the 3 forest stands was found by removing and burning off 10 dried 1-foot square samples from each. The loss-on-ignition weights representing combustible and volatile organic matter when converted into pounds per acre was 26,968, 19,661 and 14,400 pounds respectively for shortleaf pine, chestnut oak and white oak stands. If litter weights for the oak sites are adjusted to unity as representing what they would be with full crown density they become 26,968, 22,076 and 24,000 pounds per acre, respectively. In 65 years from abandonment, the shortleaf pine site acquired a greater accumulation of litter than either of the permanent hardwood sites.

Table 1.--Species, basal area, and number of trees per acre on shortleaf pine, chestnut oak, and white oak plots [1]

SHORTLEAF PINE PLOT

Species	Basal area					Trees				
	Dominant	Co-dominant	Intermediate	Overtopped	Total	Dominant	Co-dominant	Intermediate	Overtopped	Total
	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	No.	No.	No.	No.	No.
Shortleaf pine	66.98	32.76	9.98	.52	110.24	131	82	43	4	260
Pignut hickory		.72		5.90	6.62		4		46	50
Mockernut hickory		1.37		3.82	5.19		4		23	27
Minor species [2]				7.07	7.07					
Black gum			1.97	1.27	3.24			4	11	15
Yellowpoplar	2.38				2.38	4				4
Shagbark hickory				1.78	1.78				18	18
Total per acre	69.36	34.85	11.95	20.36	136.52	135	90	47	357	629
CHESTNUT OAK PLOT										
Chestnut oak	15.61	11.65	9.08	2.70	39.04	25	23	27	66	141
White oak	11.23	3.81	6.09	1.43	22.56	17	8	14	48	87
Black oak	5.79	6.72	1.27	.54	14.32	6	10	4	14	34
Scarlet oak	2.09	.89		.25	3.23	2	2		2	6
Mockernut hickory	1.08	.93	3.33	1.49	6.83	2	4	12	37	55
Minor species [3]				1.71	1.71					
Total per acre	35.80	24.00	19.77	8.37	87.69	52	47	57	255	411
WHITE OAK PLOT										
White oak	13.30	20.31	6.67	7.92	48.20	31	54	42	115	242
Chestnut oak	4.33	3.80	1.71	1.43	11.27	8	12	12	15	47
Black oak			4.77		4.77			15		15
Scarlet oak	6.01				6.01	8				8
Pignut hickory			.86	.37	1.23			4	12	16
Red maple			.57	1.42	1.99			4	35	39
Minor species [4]				.66	.66					
Total per acre	23.64	24.11	14.58	11.80	74.13	47	66	77	193	383

[1] Data supplied by L. F. Kellogg, silviculturist, Central States Forest Experiment Station.
[2] Dogwood, sugar maple, sassafras, and black oak.
[3] Pignut hickory, dogwood, sassafras, red maple and servicetree.
[4] Sugar maple, white ash and dogwood.

Nitrogen content of the litter of these forest stands followed roughly in quantity the weights of combustible material. Analysis of 10 litter samples from each stand gave as averages 409 pounds, 377 pounds, and 227 pounds nitrogen per acre, respectively, for shortleaf pine, chestnut oak and white oak. The re-establishment of litter on the shortleaf pine area is apparent both in total weight and in total nitrogen per acre. This should not be attributed altogether to the pine needle litter, however, because a considerable proportion of the litter was composed of the leaves of hardwood species in the understory. Figure 1 illustrates graphically the weight relations of litter and total nitrogen per acre for the 3 forest stands.

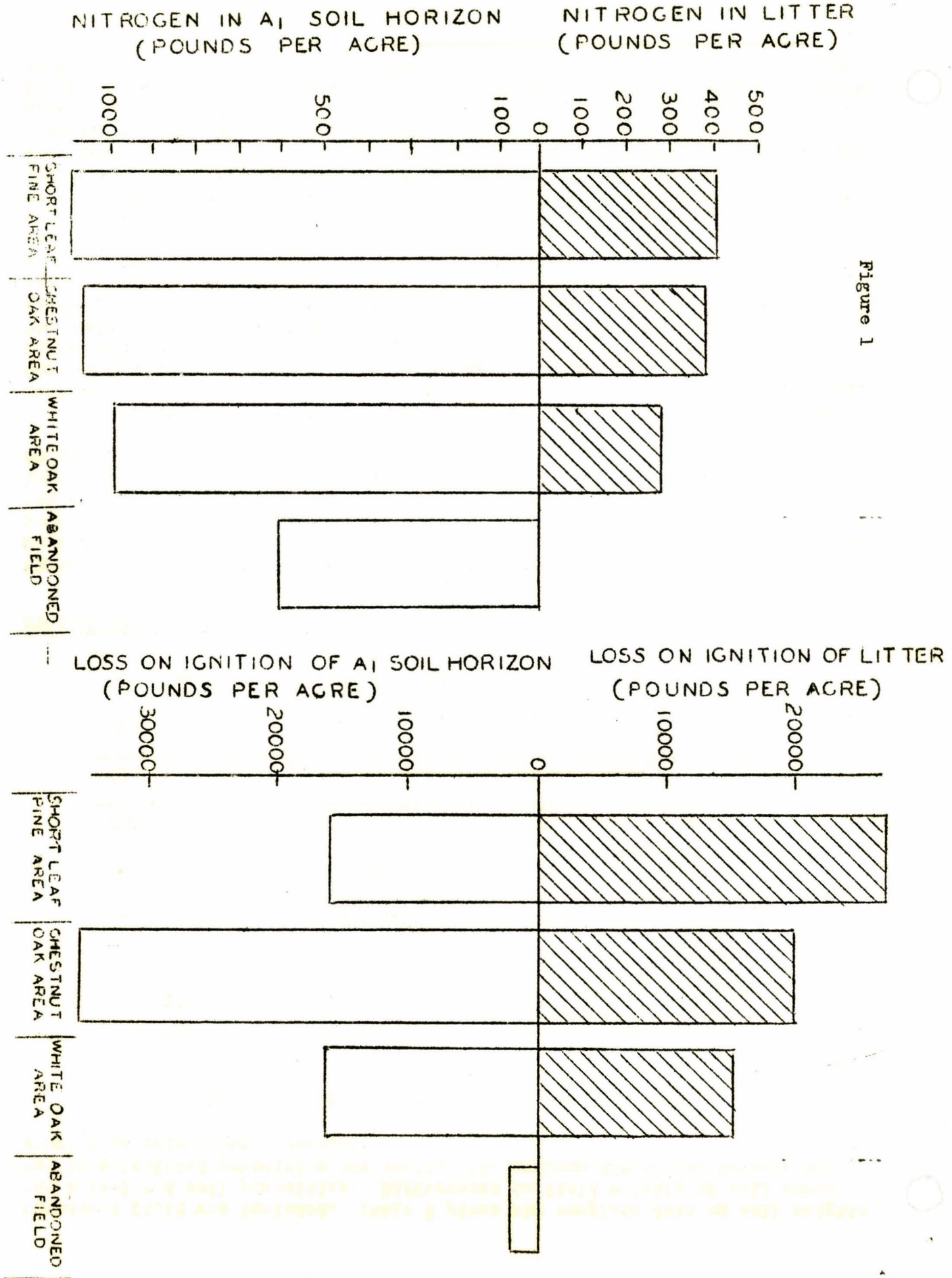
Organic Matter Incorporation

The total quantity of organic matter incorporated in the upper mineral soil of the 3 forested areas and 1 of the abandoned field areas was determined by igniting 10 surface soil samples from each. To eliminate error attributable to loss of combined water from the mineral soil, 10 samples from the A_2 horizon (that layer immediately under the darkened layer) were also ignited. It seemed reasonable to assume that the mineral soil in other respects than organic matter was relatively homogeneous in the surface and sub-surface horizons. Hence, by subtracting the loss of the A_2 from the loss of the A_1 the difference represented organic matter only. The net accumulations of organic matter in pounds per acre were 16,099 pounds, 35,620 pounds, 16,479 pounds, and 2,361 pounds per acre, respectively, for the shortleaf pine, the chestnut oak, the white oak areas and the abandoned field. The interesting observation here is the fact that organic matter accumulation in shortleaf pine soil is approximately equal to that in the second-growth white oak soil. The outstanding contrast in the comparison is the very small amount of organic matter in the soil of the abandoned field. If the soil of the abandoned field upon which the shortleaf pine regenerated was the same as that of the abandoned field adjacent to it, there is represented an increment of approximately 14,000 pounds of organic matter per acre under the shortleaf pine.

When total nitrogen in pounds per acre in the A_1 horizon is compared for the forest sites and the abandoned field site, there is a significant difference between the contents of the forest soil and the field soil. For instance, the quantities of nitrogen per acre were 1,070 pounds, 1,066 pounds, 989 pounds, and 604 pounds, respectively, for the shortleaf pine, chestnut oak, and white oak stands, and the abandoned field. Figure 1 illustrates graphically the varying weights of incorporated organic matter and nitrogen in the A_1 soil horizons of the different sites. There was pronounced accumulation of nitrogen both in the litter under the shortleaf pine and in the mineral soil.

Soil Porosity

Soil porosity probably is lowest at the time of land abandonment. Under forest cover it gradually increases. In the forest stands and in the adjacent fields of the experimental areas the relative weights of the respective soils were determined by driving $2\frac{1}{2}$-inch steel cylinders into the upper soil, digging them out, and ejecting, drying, and weighing the soil cores. One hundred soil cores, $2\frac{1}{2}$ inches in diameter and 6 inches deep, were taken from each of the forest sites and the abandoned field site. For the sake of comparison a second


NITROGEN IN A1 SOIL HORIZON
(POUNDS PER ACRE)
1000
500
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NITROGEN IN LITTER
(POUNDS PER ACRE)
100
200
300
400
500
SHORT LEAF PINE AREA
CHESTNUT OAK AREA
WHITE OAK AREA
ABANDONED FIELD
LOSS ON IGNITION OF A1 SOIL HORIZON
(POUNDS PER ACRE)
30000
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LOSS ON IGNITION OF LITTER
(POUNDS PER ACRE)
10000
20000
SHORT LEAF PINE AREA
CHESTNUT OAK AREA
WHITE OAK AREA
ABANDONED FIELD

Figure 1

abandoned field was included. Table 2 gives the complete data on soil weights and calculated soil porosities. Differences in field weights of soil cores and in calculated porosities are small. The maximum difference between any 2 samples is only about 7 percent.

Table 2.-- Weight and porosity of two abandoned field and three forest soils

Site	Volume of soil core	Air-dry weight of soil core	Soil porosity
	C. c.	Grams	Percent
Open field 1	482.59	701 1/	44.58
Open field 2	"	704	44.35
Shortleaf pine	"	661	47.75
Chestnut oak	"	610	51.76
White oak	"	640	49.39

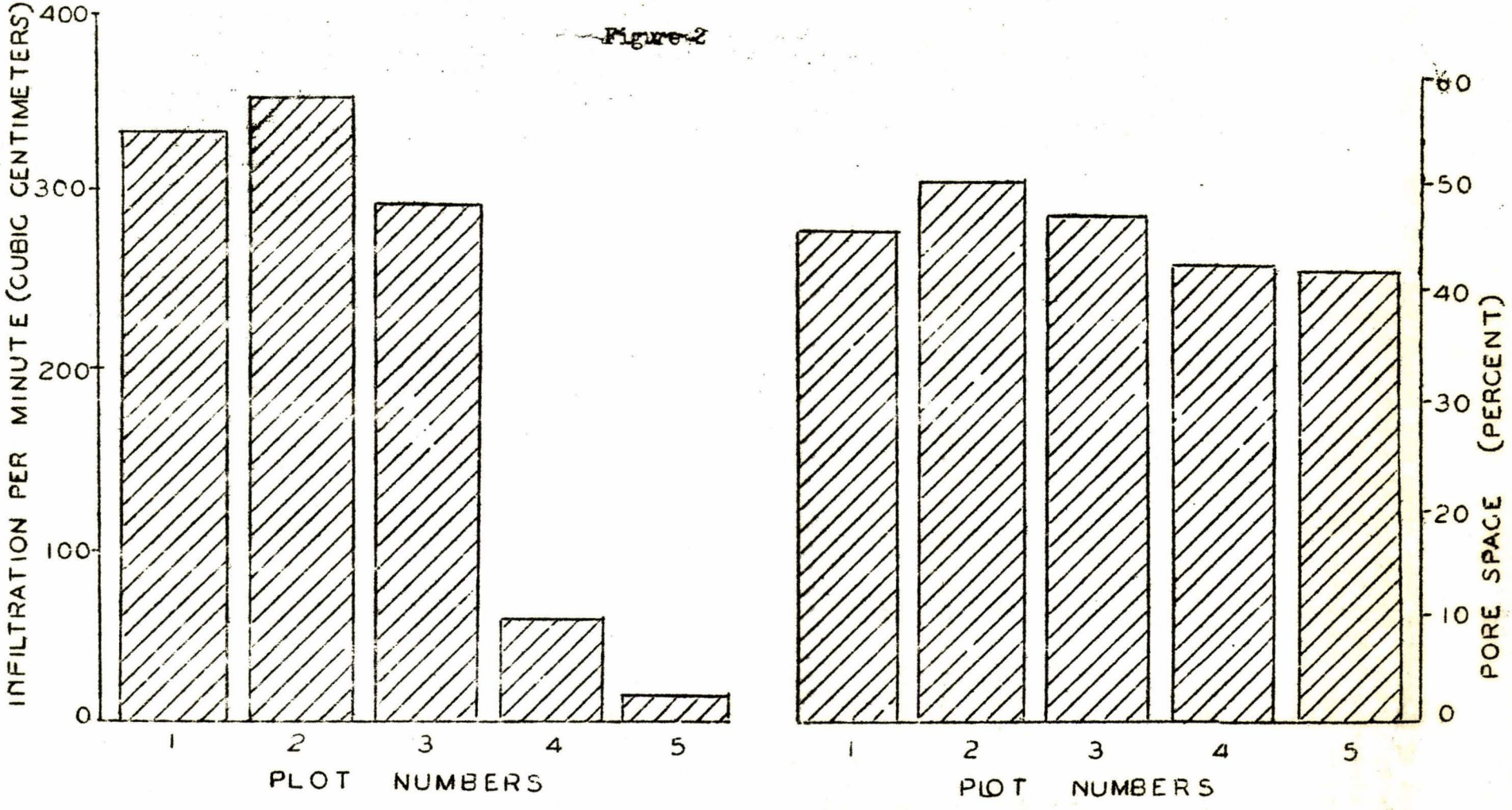
1/ Real specific gravity mineral soil 2.62.

Infiltration Rate

The really important difference between forest and field soil lies in their rates of rainfall absorption. Destruction of litter and upper soil porosity coincident with clearing and cultivation may render rainfall absorption inadequate for regeneration and growth of a hardwood forest stand. Clearing and cultivation make the site a dry one. Because of this critical dryness, the best measure of recovery of an abandoned site is its improvement in water-absorption rate.

Infiltration rates were tested on each of the 3 forest sites and the 2 abandoned field sites. Brass tubes, 2 inches in diameter and 12 inches long, were driven into the soil to a depth of about $\frac{1}{2}$ inch. The tubes were then filled with water and recession of the water level measured after 2 minutes in the woods and after 10 minutes in the field. Recession was slow in the field, hence a longer time was necessary in order to allow a readable volume to be absorbed. Sometimes recession of the water level was so rapid in the woods that it was necessary to make the measurement period much less than 2 minutes. The differences in rates must be considered, of course, only comparative, and not comparable to rainfall. The tubes had a 12-inch water head, and since the area upon which the water was applied was small and the surrounding soil dry, considerable lateral movement of water occurred. One hundred separate tests were made on each site. The infiltration rates were reduced to cubic centimeters per minute and analyzed statistically. The rates for forest differed from fields with high significance. Figure 2 illustrates graphically the infiltration rates of the 5 sites. It is interesting to note the great increase in infiltration rate associated with a very slight increase in soil porosity.

Figure 2


INFILTRATION PER MINUTE (CUBIC CENTIMETERS)
400
300
200
100
0
1
2
3
4
5
PLOT NUMBERS
60
50
40
30
20
10
0
PORE SPACE (PERCENT)
1 OLD-FIELD PINE
2 CHESTNUT OAK
3 WHITE OAK
4 ABANDONED FIELD NO. 1
5 ABANDONED FIELD NO. 2

An increase of 7 percent pore space was associated with 700 percent increase in infiltration rate. Formation of a thin, compact crust on bare field soil surfaces hinders rainfall infiltration out of proportion to total difference in soil weight; and formation of very small cracks and pores greatly increases rate of gravitational water movement.

Summary

An old field regenerated naturally from abandonment by pine in 65 years was studied in relation to a chestnut oak stand, a white oak stand, and an abandoned field. Litter accumulation under the shortleaf pine stand had risen to 26,968 pounds per acre, compared to 19,661 pounds and 14,400 pounds for the chestnut oak stand and the white oak stand, respectively. Nitrogen in litter under shortleaf pine was greater than in that under chestnut oak or white oak; the pounds per acre were 409,377, and 227, respectively. Pounds nitrogen accumulation in the first 2 inches of the mineral soil for the same 3 wooded sites were 1,070, 1,066 and 989 pounds and for the abandoned field 604 pounds.

Although porosity of the old-field pine surface soil was only 7 percent greater than that of the adjacent abandoned field, its infiltration rate was about 700 percent greater.

Forest soil conditions under a shortleaf pine stand regenerated in 65 years from an abandoned field compare favorably with those under second-growth oak stands whose soil has not been broken. The history of land use in this Muskingum silt loam area is an indication of the possibilities of forest and soil restoration in a large part of several southeastern Ohio counties.

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Technical Note 35. October 1, 1941

VOLUME TABLE[1/]
for
EASTERN WHITE PINE
(Pinus strobus)
Mohican River Gorge, Holmes County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height: 1 log	2 logs	3 logs	4 logs	5 logs	6 logs	7 logs	Basis in trees
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
7	10	20	29					4
8	13	25	38					3
9	17	32	47	62				5
10	20	39	58	76	95			6
11		47	70	92	114			7
12		56	82	109	135	161		5
13		65	96	126	157	188		6
14			111	146	182	217		5
15			127	167	208	248		5
16			144	189	235	281	326	7
17			161	213	264	316	367	5
18			180	238	296	353	410	4
19			200	264	328	392	455	6
20			221	292	362	432	503	4
21				317	399	475	552	8
22				351	436	520	604	5
23				382	475	567	659	5
24				415	516	616	715	3
25				449	584	666	774	1
26				485	602	719	835	1
27					648	773	899	-
28					695	830	964	1
Basis in trees--number	4	8	13	24	31	11	5	96

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken to 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared, in 1941, by the equation method. Coefficient of multiple correlation (R) = .995. Standard error of estimate, approx. 10% of estimated volume. Block shows limits of basic data.

F. A. JOHNSON

J. RICHARD CRAWMER

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Technical Note No. 36 October 1, 1941.

VOLUME TABLE 1/
for
Eastern HEMLOCK
(Tsuga canadensis)
Holmes County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height						Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Number
8	14	27	41				4
9	18	34	51				7
10	22	42	62	83			5
11	26	50	75	100			8
12		59	88	118	147		6
13		69	103	137	172		6
14		80	119	158	198		5
15		91	136	180	226		5
16		103	153	204	255		6
17			172	229	286	344	7
18			192	256	320	384	3
19			213	284	354	426	7
20			235	313	391	469	6
21			258	343	429	515	4
22			282	375	469	563	5
23			306	408	510	613	3
24			333	443	554	665	2
25			360	479	599	719	3
26			388	516	645	775	2
27				555	694	833	-
28				595	744	893	1
29					795	955	-
30					848	1018	-
31					903	1085	2
Basis in trees--number	4	16	21	25	21	10	97

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log.

Table prepared in 1941 by the equation method. Multiple correlation coefficient (R) is .99. Standard error of estimate is approximately 10% of estimated volumes. Blocks show limits of basic data.

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The total estimated gross volume of single hemlock trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the elements comprising cull, combined with local experience of millmen as regards losses from rot, shake, etc. in utilizing this species.

Floyd A. Johnson

J. Richard Krawmer

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Technical Note 37. October 1, 1941.

VOLUME TABLE 1/
for
BLACK GUM or BLACK TUPELO (Nyssa sylvatica)
Holmes County, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height						Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
7	9	15					6.1	-
8	13	21	27				6.3	4
9	18	28	37				6.5	4
10	23	37	48	59			6.7	4
11	29	47	62	75			6.9	7
12	37	59	77	93			7.1	4
13		72	94	115			7.3	4
14		87	114	139			7.6	2
15		104	136	166	192		7.9	6
16		123	161	195	227		8.1	5
17		143	188	228	265		8.5	3
18		166	218	264	307		8.9	4
19			250	303	352		9.3	4
20			285	346	402		9.8	4
21			323	392	455	514	10.4	3
22			364	442	513	580	11.0	4
23			408	495	575	649	11.6	4
24			455	552	641	724	12.2	1
25			505	613	711	804	12.9	5
26			559	678	787	889	13.6	2
27				746	867	980	14.4	1
28				819	952	1075	15.1	1
29				896	1041	1176	15.9	1
30				978	1135	1283	16.7	1
31					1235		17.4	-
Basis in trees--number	5	7	26	19	19	3	-	78

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "the Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1941 by the equation method. Multiple correlation coefficient (R) was .991. Standard error of estimate is approximately 17% of estimated volumes. Block shows limits of basic data.

The total estimated gross volume of single black gum trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the elements comprising cull combined with local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

Floyd A. Johnson

J. Richard Crawmer

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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

In cooperation with
Ohio Agricultural Experiment Station

Technical Note 38 October 1, 1941

LOG GRADE OF TIMBER IN EASTERN OHIO:
I. EASTERN WHITE PINE ON MOHICAN RIVER GORGE, HOLMES COUNTY, OHIO

L. F. Kellogg, Silviculturist

Although sawmill operators in the Central States Region have a general knowledge of the quality of the region's remaining standing timber, usually they are not aware of the variation in log grade with variation in tree diameter. The relation of tree diameter to log grade is an important consideration in judging whether manufacture of a given lot of timber is likely to yield a profit. High-grade material in sufficient volume commands a market and a price, but low-grade logs have low value and are a drug on the market. Also, the quality of the material obtainable from trees of a given species in a given locality has an important bearing on the degree to which the species should be favored in the handling of local woodlands. For these reasons, any information on log quality and grade for the timber in this region has distinct value. In connection with checking a volume table intended for use in the Ohio Forest Survey, data were recently obtained on the log grades of some white pine timber near Loudonville, Holmes County, Ohio, that afford an indication of the variation of log grade with diameter for this species.

Eastern white pine (Pinus strobus) occurs in scattered localities in the eastern half of Ohio, with hardwoods and occasionally hemlock as associates, on hilly to steep land usually having thin sandy soils overlying sandstone. These stands form a portion of the southern fringe of the conifer forest of the Lake States. Perhaps the most extensive white pine stands in Ohio are those in the gorges and the immediate vicinity of Clear Fork and the Mohican River, which extend from the neighborhood of Perrysville, in southern Ashland County, southward along the boundary of Knox and Holmes Counties to the neighborhood of Brinkhaven. In this locality black, scarlet, and chestnut oaks and shagbark hickory grow commonly on the ridge tops. On north-facing slopes the forest is composed largely of white and red oak, sugar maple, red maple, beech, white ash, yellowpoplar, elms, and black walnut and, frequently, hemlock. White pine appears most frequently on south- and west-facing slopes, but is not limited to them. It occurs both as single trees in mixture with hardwoods and as almost pure stands of very limited extent. Young growth of white pine occurs somewhat erratically. Protection from fire is necessary to maintain white pine as a component in the stands. Cutting during the past century, sometimes repeated, appears to have altered the distribution of this species very little. The lumber probably does not enter the market except locally as a custom-sawn product for farm or town use.

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In the Loudonville locality, the stands near the ridge tops are of an even-aged oak-pine type, containing black and scarlet oaks and some chestnut oak and shagbark hickory in mixture with the white pine. On such sites chestnut formerly was common. On lower slopes the associates of white pine include red oak, white oak, black gum, red maple, and slippery elm. The logs in 104 white pines on west-facing slopes were graded by James W. Girard, Assistant Director of the Nation-wide Forest Survey. The log lengths in these white pine trees varied from 12 to 16 feet, depending on the occurrence of limbs, sweep, or stubs and their effect on log grade. Log grading was based on minimum diameter, proportion of clear surface on the three visible faces, and expected size of clear cuttings as governed by distribution of limbs, stubs, and other defects. The volume and log-grade data obtained are summarized in table 1.

Table 1.--Log grades and gross volume, equivalent to green lumber mill tally, of eastern white pine trees of different diameters,1/ Mohican River Gorge, Holmes County, Ohio

D. b. h. class (inches)	Basis in trees	Average tree		Logs (12- to 16-foot), by grade			Distribution of gross volume by log grade, and its total		
		Merchantable length	Volume	#1	#2	#3 2/	#1	#2	#3
	Number	Ft.	Bd. ft.	Number	Number	Number	Percent	Percent	Percent
10	33	22	45	None	2	54	6	22	72
12	27	43	109	5	18	57			
14	19	51	175	16	15	37	30	30	40
16	20	57	270	13	20	45			
18	4	66	381	3	5	9	30	36	34
20	1	64	473	1	1	2			
All classes	104	-	-	38	61	204	22.8	28.4	48.8
							Bd. ft.	Bd. ft.	Bd. ft.
							3,465	4,312	7,378

1/ These trees possess higher form and greater merchantable length than those in most other parts of Ohio.

2/ Two logs of this grade were only 10 feet long.

Whereas 10-inch white pines have an average merchantable length of only 1.8 12-foot logs (22 feet), a 16-inch tree contains on the average 4.7 such logs and a 20-inch tree contains 5.3. Although these data do not show it, white pines attain a diameter of 28 inches in this locality. The proportion of number 1 logs increases from none in 10-inch trees to about 30 percent in 18- and 20-inch trees. The proportion of number 3 (lowest-grade) logs drops from 72 percent for 10- and 12-inch trees to about 34 percent for 18- and 20-inch trees. Of the total volume of this sample, almost a quarter was contained in number 1 logs and half was contained in number 1 and 2 logs.

Thus, timber owners or millmen in this locality who cut 10-inch white pines obtain from them only small logs of the lowest grade, which yield undesirable low-value lumber, of the knotty common grade. Large-diameter trees, which contain a high proportion of number 1 logs, will yield some clear high-grade lumber, which will meet exacting requirements and may command a good local price. Plenty of common lumber will be available from the centers of the number 1 and number 2 logs and the yield of number 3 logs. Others have pointed out the financial loss in cutting small trees containing only low-grade logs and the increasing profit from selecting and cutting only large trees containing high-quality logs. In this case, data showing the profit and loss resulting from these practices are unavailable.

In table 1, two facts stand out:

1. It is shortsighted to sell or cut sound, thriftily growing 10- or 12-inch eastern white pine trees, which contain predominantly low-grade logs. Such logs command only a low price and yield only low-grade material. If the trees are sound, thrifty, and a good risk, they should be left to grow.

2. After the trees reach a diameter of about 18 inches their increase in merchantable length (in logs) apparently levels off but their volume continues to increase rapidly. If the trees have been well pruned, either by side crowding or artificially, they lay on high-quality wood. It appears to be good business to hold thrifty trees until they are 18 inches or more in diameter before cutting them.

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Technical Note 39.

VOLUME TABLE 1/ for CHESTNUT OAK (Quercus montana)

Monroe, Muskingum, Pike, Ross, and Washington Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 16.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1/2 log	1 log	1½ logs	2 logs	2½ logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	15	24	33			6.8	27
10	19	32	43	53		7.3	
11	24	40	54	67		7.8	31
12	30	50	67	84	99	8.3	
13	36	61	82	102	120	8.9	10
14	44	73	99	123	145	9.5	
15	52	87	118	146	172	10.1	16
16	61	102	138	171	202	10.7	
17	82	119	161	199	235	11.4	7
18	94	137	186	230	271	12.0	
19		157	213	263		12.7	2
20		179	242	299		13.4	
21			273	338		14.1	1
22			306	379		14.8	
23			343	424		15.5	-
24			381	472		16.2	
25			422	522		16.9	1
26			466	575		17.6	
27			512	632		18.4	-
28			560	693		19.1	
29			611	757		19.9	3
30			665	824		20.6	
Basis in trees--number	17	27	39	13	2	--	98

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths, and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .995. Band of the standard error of estimate, 92.5 to 108.1 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single chestnut oak trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

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Technical Note 40.

November 1, 1941

VOLUME TABLE 1/
for
SLIPPERY ELM
(Ulmus fulva)

Ross, Knox, and Medina Counties, Ohio

Merchantable Stem to a Variable Top Diameter (INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height				Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	20	32	42		7.1	7
10	26	42	56	68	7.4	
11	33	54	71	87	7.7	19
12	42	68	90	109	8.2	
13	52	83	110	134	8.8	9
14	63	101	134	163	9.5	
15	75	121	160	195	10.2	6
16	89	143	190	231	10.9	
17		168	222	271	11.6	4
18		195	258	315	12.3	
19		224	297	362	13.1	4
20		256	340	414	13.8	
21		291	386	470	14.6	2
22		329	434	531	15.4	
23			489		16.1	1
24			547		16.9	
Basis in trees--number	11	26	13	2	--	52

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths, and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .983. Band of the standard error of estimate, 86.9 to 115.0 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single slippery elm trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

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Technical Note 41.

November 1, 1941

VOLUME TABLE 1/
for
SHAGBARK, PIGNUT, AND BITTERNUT HICKORIES
(Hicoria ovata, H. glabra, & H. cordiformis)
Pike, Ross, Monroe, Gallia, Coshocton, Medina, Richland and Holmes Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height				Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	21	37			7.3	14
10	27	47	65		7.6	
11	33	58	81		7.9	31
12	41	71	99	126	8.3	
13	49	86	119	151	8.7	24
14	58	102	141	179	9.1	
15	68	119	166	209	9.5	18
16	79	138	192	243	10.0	
17		158	220	279	10.4	14
18		181	251	318	10.9	
19		205	284	360	11.4	7
20		230	320	405	11.9	
21			357	452	12.5	4
22			398	504	13.0	
23				557	13.5	-
24				614	14.0	
25				674	14.6	1
26				738	15.1	
27				805	15.7	
28				875	16.2	
Basis in trees--number	26	24	50	13	--	113

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1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths, and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .991. Band of the standard error of estimate, 90.2 to 110.9 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single hickory trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer

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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 42.

November 1, 1941

VOLUME TABLE 1/
for
SHORTLEAF PINE
(Pinus echinata)
Jackson and Gallia Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	22	41	58			6.8	25
10	28	50	72	93		7.0	
11	34	62	88	114		7.4	33
12	41	74	106	136		7.8	
13	48	88	126	162	196	8.2	8
14	56	103	147	189	230	8.8	
15	66	119	170	219	266	9.4	5
16		137	195	251	305	10.1	
17			222	285	346	11.0	1
18			251	322	391	11.9	
Basis in trees--number	12	17	39	3	1	--	72

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .975. Band of the standard error of estimate 89.5 to 111.7 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single shortleaf pine trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

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U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION

Technical Note 43.

November 1, 1941

VOLUME TABLE 1/
for
PITCH PINE
(Pinus rigida)
Jackson and Hocking Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height			Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	21	34	44	6.5	24
10	27	43	56	6.9	
11	33	53	69	7.5	23
12	41	64	84	8.0	
13	49	77	101	8.6	5
14	57	91	119	9.1	
15	67	106	139	9.7	3
16	77	122	160	10.4	
17		140	184	11.0	1
18		160	209	11.7	
Basis in trees--number	25	26	5	--	56

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths, above a 1-foot stump, and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .92. Band of the standard error of estimate, 82.4 to 121.3 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single pitch pine trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer

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November 1, 1941

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VOLUME TABLE 1/ for VIRGINIA PINE (Pinus virginiana) Pike and Hocking Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height				Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	19	34	47	60	6.9	56
10	24	43	59	75	7.1	
11	30	52	73	92	7.3	44
12	36	63	88	111	7.7	
13	42	74	104	132	8.0	5
14	50	87	122	154	8.5	
15		101	141	179	9.0	3
16		116	162	205	9.6	
17			184	233	10.2	3
18			208	264	10.9	
Basis in trees--number	23	54	30	4	--	111

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths, and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .978. Band of the standard error of estimate, 89.7 to 111.4 percent. Block shows limits of basic data. Statistical assistance furnished by personnel of WPA Official Project No. 65-2-42-296.

The total estimated gross volume of single Virginia pine trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of sawmill operators as regards losses from rot, shake, etc., in utilizing this species.

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Ohio Agricultural Experiment Station
Department of Forestry

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VOLUME TABLE 1/
for
AMERICAN BEECH
(Fagus grandifolia)
Franklin, Stark and Holmes Counties, Ohio

November 15, 1941

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (1/4" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
8	17	29	39			6.6	2
9	23	38	52			6.9	2
10	30	50	67	84		7.3	11
11	37	63	85	106		7.7	5
12	46	77	105	131		8.2	15
13	56	94	128	159		8.7	9
14	67	113	153	190		9.2	7
15	79	134	182	225		9.8	7
16	93	157	212	264		10.4	5
17	108	182	246	306		11.1	5
18	124	209	283	352	416	11.8	13
19	142	238	324	402	474	12.5	13
20	160	270	366	455	538	13.2	13
21		304	413	513	605	14.0	3
22		341	462	574	679	14.7	5
23		380	515	640	757	15.4	7
24		422	572	710	840	16.2	8
25			632	785	929	17.0	2
26			695	863	1021	17.8	7
27			762	946	1119	18.6	5
28			834	1035	1225	19.4	3
29			908	1127	1334	20.2	3
30			986	1225	1449	21.0	3
31			1069	1327	1570	21.9	-
32			1156	1435	1698	22.8	2
33			1245	1545	1828	23.7	-
34			1340	1663	1968	24.6	2
35				1786		25.5	-
36				1914		26.4	-
37				2046		27.4	-
38				2183		28.3	-
39				2328		29.3	1
Basis in trees--number	8	33	56	52	9	--	158

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as

12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) = .990. The band of the standard error of estimate is 86.2 to 115.8 percent. Block shows limits of basic data.

The total estimated gross volume of single beech trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer
J. Richard Crawmer
W. O. Schramm

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VOLUME TABLE 1/
for
SUGAR MAPLE
(Acer saccharum)

Ashtabula, Geauga, Highland, Mahoning, Medina, Portage, Pike, Richland, Ross and Knox Counties, Ohio

Merchantable Stem to a Variable Top Diameter INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	21	37	52			6.8	75
10	27	48	66			7.3	
11	34	59	82			7.8	51
12	41	72	100			8.3	
13	49	86	120			8.9	51
14	58	103	143	181		9.4	
15	68	120	168	212		9.9	42
16	79	139	194	246		10.4	
17	91	160	223	282		11.0	29
18	103	182	254	321		11.6	
19	117	206	288	364		12.1	35
20	131	232	323	408		12.7	
21	147	259	361	457		13.2	27
22	163	288	402	508		13.8	
23	181	319	445	562		14.4	27
24	200	352	491	621		15.0	
25	219	386	538	681		15.6	21
26	239	423	589	745	895	16.2	
27	261	461	643	813	977	16.8	5
28	284	501	698	883	1062	17.5	
29		543	757	957	1151	18.1	4
30		586	817	1033	1242	18.8	
31		632	881	1114	1340	19.5	8
32		679	946	1197	1439	20.2	
33			1016	1285	1545	20.9	3
34			1089	1377	1656	21.7	
35			1161	1469	1766	22.4	5
36			1239	1567	1884	23.2	
37			1318	1667	2004	24.1	1
38			1403	1774	2133	25.0	
39			1489	1884		25.9	2
40			1578	1995		26.8	
Basis in trees--number	70	131	144	39	2	--	386

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths above a 1-foot stump and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .995. Band of the standard error of estimate is 90.2 to 110.9 percent. Block shows limits of basic data.

The total estimated gross volume of single sugar maple trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

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Technical Note 47. November 15, 1941

VOLUME TABLE 1/
for
AMERICAN SYCAMORE
(Platanus occidentalis)

Belmont, Holmes, Knox, Lawrence, Pike and Richland Counties, Ohio

Merchantable Stem to a Variable Top Diameter INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	19	36	51			6.6	16
10	24	45	65	84		7.0	
11	30	56	80	104		7.4	47
12	36	68	97	126		7.8	
13	43	81	116	151		8.1	21
14	51	96	137	178		8.6	
15	58	111	160	208		9.0	17
16	69	129	185	240	294	9.4	
17	79	147	212	275	336	9.8	31
18	90	168	241	313	382	10.3	
19	101	189	272	353	432	10.8	13
20	114	212	305	395	483	11.3	
21		237	340	442	540	11.8	11
22		262	378	490	598	12.3	
23		290	417	541	661	12.8	10
24		319	459	596	728	13.4	
25		349	502	652	796	14.0	11
26		381	548	711	869	14.6	
27		415	597	774	946	15.4	3
28		450	647	840	1026	16.1	
29		486	700	908	1109	16.9	1
30			755	980	1197	17.7	
31			813	1054	1288	18.6	2
32			873	1132	1384	19.4	
Basis in trees--number	26	39	64	52	3	--	183

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths above a 1-foot stump and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .988. The band of the standard error of estimate is 84.5 to 116.8 percent. Block shows limits of basic data.

The total estimated gross volume of single sycamore trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

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VOLUME TABLE 1/ for BLACK CHERRY (Prunus serotina)

Ashtabula, Monroe, Muskingum, Perry, Pike, Portage, Richland, Ross and Stark Counties, Ohio

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	22	38	52			7.0	16
10	28	48	67			7.1	
11	35	60	83			7.3	27
12	42	73	101	128		7.5	
13	51	89	122	154		7.8	28
14	61	105	145	182	218	8.2	
15		123	170	214	255	8.6	30
16		143	197	248	297	9.1	
17		164	227	286	341	9.6	21
18		188	259	327	390	10.3	
19		213	294	370	442	11.0	12
20			331	417	498	11.7	
21			371	467	557	12.5	3
22			412	519	619	13.4	
23			457	575	687	14.4	2
24			505	635	759	15.4	
25				698	834	16.5	
26				764	912	17.7	
Basis in trees--number	2	21	64	41	11	--	138

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths above a 1-foot stump and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .981. Band of the standard error of estimate is 87.2 to 114.6 percent. Block shows limits of basic data.

The total estimated gross volume of single black cherry trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

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TECHNICAL NOTE 49 DECEMBER 1, 1941

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NOTES ON OLD-GROWTH FORESTS

IN

OHIO, INDIANA AND ILLINOIS

BY

JOHN T. AUTEN
SILVICULTURIST

U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CENTRAL STATES FOREST EXPERIMENT STATION
COLUMBUS, OHIO

Figure 1. Typical Old-Growth Stand, Cox Woods, Orange County, Indiana

U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note 49. December 1, 1941.

NOTES ON SOME OLD-GROWTH FORESTS IN OHIO, INDIANA, AND ILLINOIS

By

John T. Auten,
Silviculturist

The disturbing increase in acreage of abandoned land in the Central States has heightened interest in the region's few remnants of old-growth hardwood forest. Studies are being made to determine what kinds of trees originally grew on different kinds of soil, what was the original character of the soil, how many trees grew on an acre, and how large the trees were at maturity.

Many of the reputedly original forest remnants in Ohio, Indiana, and Illinois were visited by the writer during the summer of 1930. Figure 1 represents a typical old-growth stand, the Cox Woods in Orange County, Indiana. Such remnants were scarce even then. Out of 50 stands visited, only 22 were found to have been little disturbed by cutting, fire, or grazing. Most of the 22 had been preserved for purely sentimental reasons. Relative inaccessibility before the advent of hard roads had saved a few old woods from early destruction. These stood for a long time because they were rarities, but in recent years they have been cut one by one until today very few remain. The best timber probably was cut early in the period of white settlement. Later, many woods of better-than-average quality were preserved through pride of ownership. Just how much better than average these remnants were could not be determined. They were the only possible source of a record that can never be complete.

The 22 widely scattered old-growth forest remnants differed greatly in tree species composition. In most cases two or three species predominated; accordingly, the stands were grouped on the basis of the two or three most prevalent species. In table 1 the forests are ranked with reference to moistness of site, from white pine on dry sites to elm - ash - maple on wet sites. The forest-association names used in this paper can easily be correlated with officially recognized types.

Basal Area

Basal area, or the sum of the cross-sectional areas at breast height of all trees 1 inch and more in diameter on an acre, varied between 106 and 185 square feet, averaging 139 square feet. A single tree having a diameter of 13 feet would approximately equal in basal area all the trees on an average acre of virgin hardwood forest. Of the average basal area per acre, 139 square feet, only 13 square feet was in the understory and 126 square feet (91 percent) was in trees 12 inches and more in diameter.

Basal area might reasonably be expected to vary greatly with soil moisture and topography, but the largest basal area is not always found on moist sites. Yellow poplar is found at its best in cool, moist, sheltered coves where the soil is deep, well watered, and well drained; on uplands its growth rate is less, its height and form poorer; on dry, exposed uplands it either does not occur at all or merely persists. A dry site that would not support a stand of ash, yellow poplar, and walnut is often capable of supporting a good growth of pine. The sites occupied by the white pine stands represented in table 1 probably would not have met the requirements of yellow poplar, but they supported an average of 185 square feet basal area of timber per acre, compared with 139 square feet per acre in the mixed mesophytic stands containing yellow poplar.

Trees per Acre

A casual glance through an old-growth hardwood stand sometimes gives the impression of large numbers of trees, but usually an actual count shows that the number per acre is small. In the stands of types other than white pine and oak - chestnut, dominant and codominant trees averaged 55 per acre. The average number of intermediate and overtopped trees per acre in these stands, including all trees of the understory, was 222. The pine and oak - chestnut sites had more trees of large size per acre than any other of the sites examined.

Largest Trees

Only one tree more than 4 feet in diameter was found in the 22 old-growth woods--a 49-inch bur oak. A 44-inch black walnut found in Turkey Run State Park, Ind., and a 48-inch yellow poplar found near Haverhill Station, Ohio, were unique for their species in this

study. Although this survey did not include a river-bottom forest, it is known that sycamore trees 8 feet in diameter, fairly common on river-bottom lands 40 years ago, are rare now. The maximum diameters for the 22 individual woods averaged 43 inches. The greatest height measured, that of an American elm in Paulding County, Ohio, was 160 feet. Mean height of dominant stand averaged 97 feet.

Species Recorded

Tree species tallied in the overstories of the 22 woods totaled 41. The greatest average number of species for any forest type was 19. Table 2 summarizes the data on species distribution, by forest type, of the basal area of the 22 stands. In nearly every case two species made up the greater part of the total basal area of the dominant stand. The preponderant part of the total basal area was of 11 hardwood species: white, black, red, and bur oaks, white ash, red and sugar maples, beech, sycamore, yellow poplar, and black walnut. White pine was scarce. Chestnut, having been killed by blight, remained only as scattered sprouts.

Density of Stands

The popular picture of virgin hardwoods is one of closed canopy, dense stands of large trees, and deep shade. This is a true picture of some virgin woods, but not of all. Some of the virgin hardwood stands of this region were dense, some were sparse. Many dry ridges on the western margins of the region supported only very open stands of scrubby timber. East of the Mississippi, except for prairie openings, the forests were more dense and contained larger trees. Board-foot volume per acre varied greatly. The 20 hardwood stands examined in this study probably were above the average of the original hardwood stands in volume. Their average volume per acre was 20,800 board feet, whereas the average for the 2 white pine stands was 30,500 board feet. These board-foot volumes were calculated on the basis of tree diameters and dominant heights, by use of volume tables from various sources

Soils

The arrangement of forest associations in order of moistness of site in table 1 discloses relations between forest association and soil. For instance, the white pine and oak - chestnut plots were on Lordstown soil and

Table 1.--Some observations and measurements on timber and soil of 22 old-growth forest remnants

Forest Association[1/]	Stands	Average trees per acre			Average basal area per acre			Average height of dominant stand
		Dominant and co-dominant	Intermediate and overtopped	All crown classes	Dominant and co-dominant trees	Intermediate and overtopped trees	All trees	
	Number	Number	Number	Number	Sq.ft.	Sq.ft.	Sq.ft.	Feet
White pine	2	183	225	408	174	11	185	100
Oak-chestnut	2	110	285	395	157	12	169	102
Oak-hickory	3	56	190	246	118	9	127	83
Oak-beech	3	47	288	335	114	12	126	88
Beech-maple	3	63	308	371	102	10	112	98
Oak-hickory-yellow poplar	4	57	203	260	134	14	148	100
Mixed mesophytic	3	53	251	304	123	16	139	98
Elm-ash-maple	2	52	95	147	89	17	106	113

1/ Associations are listed in order of increasing moistness of the sites on which they were found.

Volume per acre of trees 12 inches and larger in d b h.	Largest tree			Soil types represented	Average depth of litter	Average depth of A_1 soil horizon
	Species	Diameter	Height			
Board feet		Inches	Feet		Inches	Inches
30,500	Eastern white pine	32	106	Dubuque silt loam Lordstown silt loam	0.4	1.0
25,900	White oak	48	124	Muskingum silt loam Lordstown silt loam	.5	2.0
22,900	Bur oak	49	82	Meigs silt loam Dubuque silt loam Clarion silt loam	.4	2.0
16,700	White oak	45	98	Avonburg silt loam Canfield silt loam Avonburg silt loam	.4	1.3
19,700	Beech	37	102	Crosby silt loam Cincinnati silt loam Griffin sandy loam	.5	1.8
24,500	Yellow poplar	48	152	Muskingum sandy loam Bainbridge silt loam Orleans silt loam Ava silt loam	.5	2.8
21,100	Black walnut	44	130	Plainfield sand Genesee silt loam Bratton silt loam	.4	3.0
14,800	American elm	48	160	Fulton silt loam Clyde silty clay loam	.2	3.0

Table 2.--Basal area per acre of the overstory trees of 22 remnant old-growth stands, by tree species and forest association

Tree species 1/	White pine	Oak-chestnut	Oak-hickory	Oak-beech	Beech-maple	Oak-hickory-yellow poplar	Mixed mesophytic	Elm-ash-maple
	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.	Sq.ft.
Eastern white pine	147.0							
Chestnut	17.5	37.1		3.7			0.6	
Chestnut oak	4.8		0.9					
Red maple	4.2	16.1		1.6		0.1		17.9
Sassafras	0.6		0.2	1.5		1.6	0.2	
White oak		89.1	19.7	39.8		42.2	10.2	
Black oak		3.9	24.9	2.5		2.7	1.0	
Bitternut hickory		2.6		0.2				3.0
Shagbark hickory		5.7	3.2	1.4		5.7	0.6	
Northern red oak		1.2	18.5	5.4	0.1	6.5		9.1
Black cherry		0.5			0.4			
Black gum		0.3		10.6		6.4	5.3	
Beech		0.4	0.8	29.0	52.1	4.3	19.1	0.9
Pignut hickory		0.2		0.5		5.3	0.7	
Yellow oak			11.1			0.1		
Bur oak			17.5					
White ash			3.6	2.3	1.0	1.8	7.5	9.8
Yellow poplar			2.3		1.7	49.2	15.1	2.4
Sugar maple			8.3	8.4	40.1			3.8
Basswood			3.9		0.1	0.3	1.9	4.2
Hackberry			3.2		2.0		0.5	
Pin oak				1.8				
Red elm				1.6	0.1	0.9		
American elm				3.7	1.4		1.2	23.1
Black walnut				0.4	0.1	4.5	11.9	2.0
Sycamore					1.7		34.8	
Ohio buckeye					0.9			
Red mulberry						1.4		
Mockernut hickory						0.8	3.1	
Butternut							2.6	
Rock elm							4.9	
Shellbark hickory							1.5	
Black ash								11.6
Swamp white oak								0.7
Black willow								0.7

1/ Both species and associations are listed in order of increasing moistness of the sites on which they were found.

ridge phases of Muskingum and Dubuque soils--all dry soil types, rapidly drained. The elm - ash - maple type, at the other end of the scale, was on Fulton and Clyde soils, which had comparatively high water tables. The mixed mesophytic type occurred on Plainfield, Genesee, and Bratton soils; of these the first two are deep, moist old lake-bed and stream-terrace soils, the third a well-drained limestone residual upland soil. The oak - hickory and oak - beech forest associations occurred on soils not quite so rapidly drained and dry as the Lordstown, intermediate in drainage and oxidation. Stands of the beech-maple forest type, with one exception, were on more slowly drained soils like Crosby and Griffin. The soil-forest type relations defined are broad, and there was some overlapping.

The forest soils examined were not all moist, deep, black, and mellow; some were gray, shallow, and dry. An increase in depth of the darkened upper layer (the A_1 soil horizon) from dry to moist sites is disclosed by table 1. Dark color and mellowness of the surface soil generally denote fertility; in considerable degree, the depth to which a soil is colored by organic debris classifies it for forest type. It does not, however, always indicate the quantity of wood the soil will produce. Comparison of basal areas on the dry and the moist sites contradicts any assumption that soils rich in organic matter are always superior in this respect. Soil under elm, ash, maple, yellow poplar, or walnut was in some instances blackened and enriched by organic matter to a depth of 6 or 8 inches, whereas that on some dry sites supporting pine or dry oaks was gray almost to the surface; but natural adaptation of tree species to varying degrees of site dryness tended to make yields comparable.

Litter is the principal source of organic matter in the soil, hence its quantity is important. Litter depths presented in table 1, taken in late summer, are averaged by forest association. Ten measurements were taken on each sampling area. For instance, the figure for oak - hickory - yellow poplar woods, 0.5 inch, is the average of 40 measurements, 10 on each of four plots. The surprising facts about litter depth in virgin woods are its uniformity and shallowness. In August, at its annual minimum, litter depth in these old-growth hardwood stands averaged less than 0.5 inch. Decomposition is rapid. Seldom could more than the skeletal remains of two previous years' litter be easily identified.

Infiltration

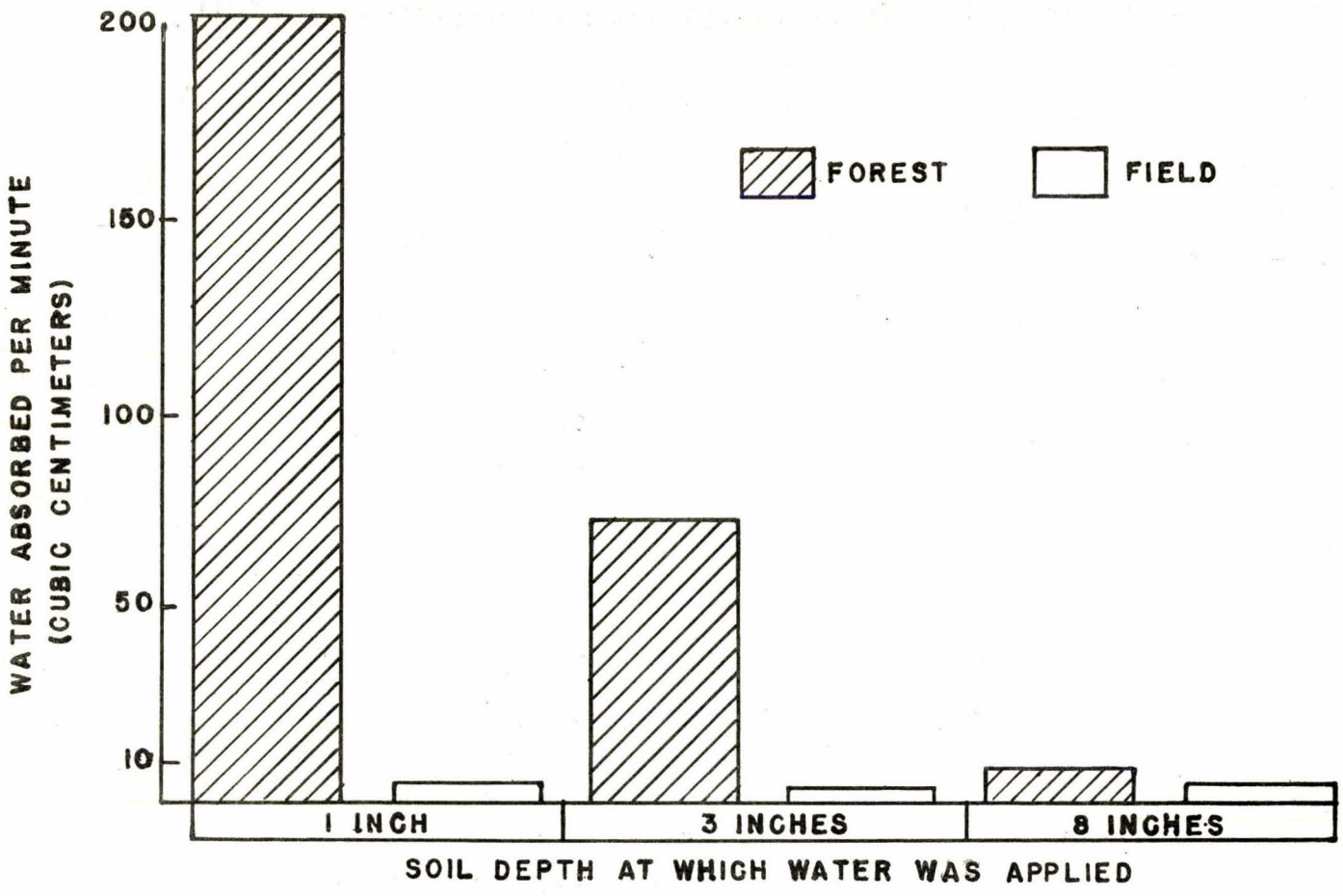
Erosion was practically absent from the virgin woods. Interlacing roots held the soil, and litter protected it from surface disturbance. As a result of soil surface protection a porous structure developed, which permitted rapid absorption of rainfall. The virgin forest soils had very highly developed porosity, and therefore great capacity for absorbing rainfall. High growth rates were made possible by large quantities of soil water. When forests were cleared and the soil cultivated, a large part of the virgin soil porosity was lost. The sites became dry because the surface soil no longer was easily penetrated by rainfall. The difference in infiltration rate is illustrated in figure 2. In an extensive series of tests forest soil at 1-inch depth absorbed water about 50 times as fast as adjacent field soil. At 3-inch depth the rate was 14 times that of field soil. Even 8 inches below the surface the rate for forest soil was more than twice that for field soil. These comparisons emphasize the superior porosity of old-growth forest soil.

Summary

Old-growth forest stands are exceedingly scarce in the central hardwood region. Most of those remaining in the region have been preserved for sentimental reasons. A study of 22 old-growth stands was made in 1930 in Ohio, Indiana, and Illinois.

When the 22 stands were grouped into eight forest associations and ranged in order of increasing moistness of their sites from white pine to elm - ash - maple, it was found that basal area was greatest on the two driest sites and that depth of A_1 soil horizon increased with moistness of site. Litter depth was fairly uniform for all forest types; at its annual minimum, in August, it averaged less than 0.5 inch. The basal areas of the 22 stands averaged 139 square feet per acre, of which 91 percent was in the overstory. On the average, in stands of types other than white pine and oak - chestnut there were 55 trees per acre in the overstory and 222 in the understory. The largest tree found was 49 inches in diameter; the tallest, 160 feet high. At depths of 1, 3, and 8 inches, respectively, the old-growth woods soil absorbed water 50, 14, and 2 times as fast as comparable field soils.

Figure 2 Comparative rates of absorption of water by the soil in old growth woods and in adjacent fields, at three depths



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Technical Note 50. December 1, 1941

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VOLUME TABLE 1/
for
PIN OAK
(Quercus palustris)

Columbiana, Portage, Richland and Trumbull Counties
Ohio

Merchantable Stem to a Variable Top Diameter INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height				Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
9	21	37	51	64	7.2	54
10	27	47	65	82	7.5	
11	33	58	80	101	7.8	51
12	40	70	98	123	8.2	
13	48	85	118	148	8.6	39
14	57	100	139	175	9.0	
15	67	117	162	205	9.6	28
16	77	136	188	237	10.2	
17	89	155	215	272	10.9	8
18	101	177	246	310	11.5	
19		200	278	351	12.2	2
20		225	312	394	12.9	
21		251	348	440	13.6	-
22		279	386	488	14.3	
23			428	541	15.1	1
24			471	594	15.8	
25			518	653	16.6	1
26			566	714	17.3	
Basis in trees--number	59	63	59	3	--	184

1/ Trees measured by J. W. Girard in 2-inch diameter classes and in 10- to 16-foot log lengths above a 1-foot stump and scaled as such. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) is .984. Band of the standard error of estimate is 88.5 to 113.0 percent. Block shows limits of basic data.

The total estimated gross volume of single pin oak trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer

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In Cooperation With
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DEPARTMENT OF FORESTRY

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VOLUME TABLE
for
BLACK MAPLE AND SUGAR MAPLE
(Acer nigrum and Acer saccharum)
Marshall County, Indiana

Merchantable Stem to a Variable Top Diameter — INTERNATIONAL Rule (¼" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height						Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
10	26	52	77	100			7.4	2
11	32	63	95	126			7.9	3
12	38	76	114	152			8.4	5
13	45	90	135	180			8.9	4
14	53	106	158	211			9.4	11
15	62	122	184	244	306		9.9	10
16	71	141	211	280	350		10.4	13
17	80	160	240	319	399		10.8	12
18	91	181	271	361	451		11.2	5
19		202	304	406	506		11.5	8
20		227	340	452	565		11.8	7
21		252	377	502	627		12.2	4
22		278	416	555	692		12.4	8
23		306	458	610	760		12.7	2
24		335	501	668	834		13.0	-
25		366	547	728	910	1091	13.3	-
26		397	596	792	989	1186	13.6	2
Basis in trees--number	-	13	44	32	6	1	--	96

Table based on measurements of wind-thrown timber in stands on good sites in which the two species occurred in mixture, totaling 59 black maples and 37 sugar maples. (Before the two sets of data for the two species were combined, they were tested for significant differences between the regressions. No such differences were found.) Data taken by representatives of the two stations. Measurements taken at variable log lengths above 1.5- to 3.0-foot stump heights and plotted on USFS Form 558-A. Trees scaled in 12-foot logs and additional shorter top logs; top sections less than 8 feet long scaled as fractions of an 8-foot log. Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) = .985. Band of standard error of estimate, 90.4 to 110.8 percent. Block shows limits of basic data.

In using the table the total estimated gross volume of single black and sugar maple trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

L. F. Kellogg
R. E. Emmer
Daniel DenUyl

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DEPARTMENT OF FORESTRY

Technical Note 52.

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VOLUME TABLE 1/
for
BLACK OAK
(Quercus velutina)
Holmes County, Ohio

Merchantable Stem to a Variable Top Diameter INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height						Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs	6 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
7	11	19	27				5.6	2
8	15	26	36	45			5.9	1
9	19	34	47	59			6.2	1
10	24	42	59	75			6.4	3
11	30	53	73	93			6.8	3
12	36	64	89	112	135		7.1	4
13		76	106	135	161		7.4	5
14		90	126	159	191		7.7	3
15		105	147	186	223	259	8.0	3
16		122	170	215	258	299	8.4	2
17		140	194	246	295	343	8.8	2
18			221	280	336	390	9.1	1
19			249	316	379	440	9.5	6
20			280	354	425	493	9.8	3
21			312	395	474	550	10.2	3
22			346	438	526	611	10.6	5
23			382	484	581	674	11.0	5
24			421	533	639	742	11.4	5
25			461	583	700	813	11.8	1
26			503	637	765	888	12.3	4
27			548	693	832	966	12.7	2
28			594	752	903	1048	13.2	1
29			643	814	976	1134	13.6	3
30			693	878	1053	1223	14.0	3
31			747	945	1134	1317	14.5	-
32			795	1015	1218	1414	15.0	-
33			859	1087	1304	1514	15.4	3
34			918	1162	1395	1619	15.9	1
35			980	1240	1488	1728	16.4	-
36			1043	1321	1585	1840	16.9	1
37			1109	1404	1685	1957	17.4	-
38			1178	1491	1789	2077	17.9	-
39			1249	1580	1896	2202	18.4	1
40			1322	1673	2007	2331	18.9	-
41			1396	1767	2121	2463	19.4	-
42			1473	1865	2238	2598	20.0	-
43			1554	1967	2360	2740	20.4	1
Basis in trees--number	1	5	19	27	23	3	--	78

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements

taken at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared, in 1941, by the equation method. Coefficient of multiple correlation (R) = .994. The band of the standard error of estimate is 88.0 to 113.3 percent. Block shows limits of basic data.

The total estimated gross volume of single black oak trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer
J. Richard Crawmer

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VOLUME TABLE[1/]

for

NORTHERN RED AND SCARLET OAKS

(Quercus borealis and Q. coccinea)

Franklin County, Ohio

Merchantable Stem to a Variable Top Diameter INTERNATIONAL Rule ($\frac{1}{4}$" Kerf)

Diameter breast high outside bark (inches)	Gross volume of stem in 12.3-foot logs to merchantable height					Top d.i.b. at merchantable limit	Basis in trees
	1 log	2 logs	3 logs	4 logs	5 logs		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
8	16	29				6.4	2
9	21	38				6.9	1
10	27	48	68			7.3	5
11	34	60	84			7.7	5
12	41	74	103			8.2	6
13	52	89	124			8.6	7
14	59	105	147			9.1	5
15	69	123	173	219	264	9.6	3
16	80	143	200	255	306	10.2	7
17	92	164	231	292	352	10.7	5
18	105	188	263	334	403	11.3	4
19	120	213	298	378	456	11.9	4
20	135	240	336	427	513	12.4	8
21	151	268	376	478	574	13.1	4
22	168	298	419	532	640	13.7	1
23	186	331	463	589	710	14.3	7
24	206	366	512	650	783	15.0	3
25	226	402	562	714	859	15.6	6
26	247	440	617	783	942	16.3	3
27	270	480	673	853	1028	17.0	1
28			731	929	1119	17.7	1
29			792	1007	1213	18.4	1
30				1089	1312	19.1	-
31				1175	1416	19.8	2
32				1265	1524	20.6	3
33				1358	1637	21.3	-
34				1455	1754	22.0	1
35				1556	1875	22.8	-
36				1660	2000	23.6	-
37				1770	2128	24.4	3
38				1884	2265	25.2	-
39				2000	2404	26.0	-
40				2118	2553	26.7	-
41				2244	2704	27.5	1
42				2317	2858	28.3	-
43				2506	3020	29.0	1
Basis in trees--number	5	29	29	27	10	--	100

1/ Trees climbed and measured by personnel of Work Projects Administration Official Project 65-1-42-166 - "The Ohio Woodland Survey." Measurements taken

at 12-foot log lengths above a 1.0-foot stump height. Scaled as 12-foot logs, and additional shorter top logs; top sections less than 8 feet in length scaled as fractions of an 8-foot log. Table prepared in 1941, by the equation method. Coefficient of multiple correlation (R) = .984. The band of the standard error of estimate is 82.0% to 122.3%. Block shows limits of basic data which include 84 red oak and 16 scarlet oak.

The total estimated gross volume of single black oak trees or stands should be corrected for cull (including defect, sweep, crook, shake, etc.) by a percentage reduction. This percentage should be determined locally through observing the cull elements and through local experience of millmen as regards losses from rot, shake, etc., in utilizing this species.

R. E. Emmer
W. O. Schramm

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Dennison

Technical Note 54. January 1, 1942

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VOLUME TABLE 1/ for WHITE OAK (Quercus alba)

UNION, JACKSON, and HARDIN COUNTIES, ILLINOIS

Merchantable Stem to a Variable Top Diameter Scribner Decimal C Log Rule in Tens

Diameter breast high (o.b.) Inches	Gross volume of stem in 16.3-foot logs to merchantable height: 1 log	1½ logs	2 logs	2½ logs	3 logs	3½ logs	4 logs	Top d.i.b. at merchantable limit	Basis in trees
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Inches	Number
10	3	3						7.3	4
11	4	4						7.7	2
12	4	6	7					8.2	4
13	6	7	8	10				8.6	6
14	7	9	10	12				9.2	7
15	8	10	12	14				9.6	7
16	10	12	15	17	19	21		10.2	3
17	12	15	18	20	22	22		10.7	6
18	14	17	21	24	26	25		11.2	8
19	16	20	24	27	31	34		11.8	2
20	18	23	28	32	35	39		12.2	4
21		26	31	36	40	44		12.8	3
22		30	36	41	46	50		13.4	3
23		34	40	46	52	57		14.0	2
24			45	52	58	64	69	14.6	1
25			51	58	65	71	77	15.2	3
26			56	65	72	79	86	15.9	1
27			63	72	80	88	95	16.6	4
28			69	79	88	97	105	17.4	1
29			76	87	98	107	116	18.2	3
30			84	96	107	117	127	19.0	2
31			91	105	117	128	139	19.8	3
32			100	114	128	140	152	20.8	2
33				124	139	152	165	21.8	2
34				135	151	165	179	22.9	1
35				146	163	179	194	24.1	-
36				158	176	193		25.4	2
37					190	208		26.8	1
Basis in trees--number	10	16	17	19	7	10	8	--	87

1/ Data taken in Union County at Huston Hollow and at Grimsby; in Jackson County at Cedar Creek Hill by O. P. Stabo of the U. S. Forest Service, Shawnee National Forest; and in Hardin County at the Kaskaskia Experimental Forest by J. G. Kuenzel and C. E. Sutton of the Central States Forest Experiment Station. Scaled as 16.3-foot log lengths above a 1.0-foot stump and as 8.15-foot top logs.

Table prepared in 1941 by the equation method. Coefficient of multiple correlation (R) was .99. Standard error of estimate is approximately 14 percent of estimated volume. Block shows the limits of basic data.

R. E. EMMER
J. G. KUENZEL
L. F. KELLOGG

Penrose

U. S. Department of Agriculture - Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note No. 55 November 1, 1942

The 1941 Production of Black Walnut Lumber in the Corn Belt States [1]

by

L. F. Kellogg
Silviculturist

Black walnut stands out as one of the important timber species in times of war. Although others can serve in the same capacities, none can quite equal or excel it as material for gunstocks. At the same time it is one of the most valuable, both in stumpage and in lumber form of any species, native to the United States, as well as to the Corn Belt States.

The following information on black walnut lumber production has been compiled from sources made available through cooperation with the Bureau of the Census in obtaining the 1941 lumber cut, in seven States, in whole or in part. This State group comprises a very important part but not all of the walnut-producing territory of the United States.

Production

The production of black walnut during 1941 in the Corn Belt States occurred in some 663 out of a total of about 3,850 producing sawmills which reported to the Census. In the following tabulation this production is reported by States, and for comparison, the 1940 production, as reported by the Census, is included. The apparent increase in production, 7,059 M bd. ft., amounts to about 33 percent over the lumber production reported a year ago. (Table 1.)

1/ Assistance with compilation work has been provided by WPA Project OP-265-2-42-24. Through that assistance, this report is available at this date. Clearance obtained for release from local Office War Information 10/10/42; and approved for issue by Census Bureau, 10/6/42.

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Table 1. -- Reported production of black walnut lumber in 1940, and in 1941, by States in the Corn Belt

State	Production of Walnut Lumber		
	1940[1]		1941
	M feet b.m.	Mills	M feet b.m.
Missouri	7,476	49	8,348
Indiana	6,157	224	9,285
Kansas	3,574[2]	49	5,074
Ohio	3,831	213	3,169
Iowa	222	63	2,072
Illinois	151	50	465
Nebraska	--[2]	15	57
Total	21,411	663	28,470

1/ Number of mills providing production not available. Official tabulation by Bureau of Census.

2/ Kansas' total includes Nebraska's.

The totals for Ohio and Indiana are more reliable than for the other States, because the Central States Forest Experiment Station made a 100 percent canvass of sawmill operations in these States, with the cooperation of the Ohio State Agricultural Experiment Station, the Wayne National Forest, the Purdue University Agricultural Experiment Station, and the Hoosier National Forest. Perhaps 80 percent of all sawmills in Kansas reported either by mail or through Extension-Farm Forester R. C. Johnson. A thorough-going mail canvass in the remaining States brought out the production given above. In the foregoing data, both full-time and incidental producers of black walnut lumber are included.

Other large and important production in 1940 occurred in West Virginia (3.7 million), Tennessee (2.87 million), Kentucky (2.7 million), Virginia (1.1 million), and Arkansas (0.9 million board feet.)

The Census reports that the total black walnut production in the United States un 1940 was 33,865 M bd.ft. Hence this list of Corn Belt States produced about two-thirds of the Nation's total.

Relative Order of State Production

Based on reported production, Indiana took first place during 1941 in output of walnut lumber in these Corn Belt States. Had it been possible for the Central States Forest Experiment Station to cover all States as it did Ohio, and Indiana, Missouri might have retained first place. As the record stands, Missouri is second, Kansas third, followed by Ohio, Iowa, Illinois and Nebraska.

Higher totals for Indiana and Kansas may have been caused by a more active market and greater war demand, particularly for gunstock blanks, but also in 1941 there was a more thorough canvass of the sawmills themselves. The decline in Ohio's production is unexplained. Apparent increased production in Iowa and Illinois may lie partly in market factors, but unquestionably more thorough field canvass for reports on production was partly responsible for the apparent increase -- particularly in Iowa.

The output of Nebraska would be larger, had logs been sawn locally. It has been reported that from July, 1940 to July, 1941, about 50 carloads, amounting to about 225 M of logs went out by rail and truck from the two southeastern counties in Nebraska to markets in Missouri, Kansas, and maybe Council Bluffs, Iowa.1/ This interstate traffic in walnut logs occurs all through the region, however, so that yearly cut does not necessarily provide an index of local supplies of standing black walnut timber. One walnut lumber dealer in Cincinnati, Ohio, draws only 10 percent of his stock from Ohio. Given consignments of logs for lumber, as well as veneer logs are known to travel long distances in some instances, by either rail or truck.

Centers of Production

Based on reported production, Kansas City, Kansas, stands out as the point of largest single output in the Corn Belt States. Inclusion of Kansas City, Mo., nearby Leavenworth, Kan., and St. Joseph, Mo. might place that locality as the largest walnut-producing center in the Nation.

New Albany, Indiana, in combination with neighboring Jeffersonville, is a good second. The walnut production of firms in Louisville are unavailable at this time and cannot be included to provide a complete picture of production in this particular metropolitan district, but its production is large. St. Joseph, Mo., Piqua, Ohio, Evansville, Ind., and Springfield, Mo., are also large centers of production in the Corn Belt.

Gone are the mills and the standing of Cincinnati, Indianapolis, Des Moines, and other points which at one time stood high in the list.

Days of Operation and Production

Generally speaking, those whose main business is walnut lumber production and who follow that largely to the exclusion of other forest products enterprises, produced most of the 1941 output. Data on continuity of operation, as expressed in days per year, are difficult to obtain. In particular, small operators seem either to have no idea how much time they have devoted to saw-

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1/ Thirty-four carloads by rail, and sixteen by truck, about a 2:1 ratio of rails to rubber.

milling, or their mill operations have been hopepessly mixed into part-time farming or other business activities. But both large and small operators frequently fail to provide this information on reports to the Census. Summarized on basis of days of mill operation, about a quarter of 1941 walnut lumber cut must be segregated as unknown. (Table 2.)

Table 2.-- Black walnut lumber production, in 1941 in the Corn Belt, by operation classes

Operation class (days per year)	Total production	
	Mills	Volume
	Number	M ft. b.m.
1 - 100	313	1,954
101 - 200	108	5,565
201 - 300	52	11,944
300 & over	3	71
Unknown	187	8,936
Total	663	28,470

It is evident that operators who saw consistently for a considerable portion of the year account for the major production. The three operators in class "301 days and over" apparently are general hardwood lumber producers who sawed a few thousand feet of walnut as part of their production.

Mill Capacity and Production

Major walnut production is related definitely to size or capacity of mill, just as it is to continuity of operation. The larger walnut lumber producers use equipment of higher daily capacity, more labor, and their operation yields more output. They consequently accounted for the largest portion of last year's production. (Table 3.)

Table 3. -- Black walnut lumber production in 1941 in the Corn Belt, by capacity of mills

Capacity of mill (M ft. b.m. per 8-hour day)	Total production	
	Mills	Volume
	Number	M bd.ft.
0.5 - 2.0	173	916
2.5 - 4.0	222	3,140
4.5 - 6.0	78	4,052
6.5 - 8.0	27	2,161
8.5 - 10.0	18	5,253
10.5 - 12.0	5	4,335
12.5 - 14.0	-	-
14.5 - 16.0	4	6,816
16.5 - 18.0	-	-
18.5 - 20.0	3	174
Unknown	133	1,643
Total	663	28,470

When the number of sawmills is considered, we note that small mills of low capacity are far the most numerous, but produced a relatively low proportion of the 1941 output.

The reported "size or capacity" of a mill is a rather indefinite statistic. There is no control over the interpretation placed on this term. Mill owners reporting by mail think it means one thing; clerks, company officials, look at the term in a different light; many are conservative; small mill owners lack labor or logs or both. As a consequence the full potential capacity of a given set of sawmill machinery, be it a "portable" or a"permanent" mill, probably is seldom reported. Rather, the average or usual capacity appears in Census reports, and to that extent the above compilation is an understatement of fact.

On the basis of size of production, the Corn Belt States divide into two groups: (a) States in which the bulk of production occurs in sawmills producing less than 100 M bd.ft. annually. About 78 percent of the walnut lumber produced in Illinois and 100 percent in Nebraska came from these small mills. (b) States in which producers of 100 M bd.ft. or more manufactured over half of the State's production. The other States covered by this report all fell in this division; and in Kansas, Missouri, and Ohio producers of 500 M bd.ft. or more manufactured over half of the States' totals. Thus, the larger mills in Kansas produced 77 percent -

of the reported total; in Missouri, 88 percent; in Ohio, 58 percent; and for all States combined, mills producing 500 M and over manufactured 68 percent. Thus mills producing 500 M or more per year were decidedly the dominating factor in the manufacture of black walnut lumber in 1941. (See Table 4.)

The question may be raised how much walnut lumber could be produced by this portion of the sawmill industry, in these Corn Belt States. The question is rather academic because it presupposes (1) adequate woods and mill labor supply (which is shrinking), (2) adequate logs. The walnut business is built on an individual tree or log pickup; assembly of carload lots for shipment to large producers; or cutting of individual trees, as encountered in the woods by logging crews. (3) Good service in getting parts and repairs (which is increasingly difficult); and (4) ready markets.

Brushing aside these uncertainties, and allotting 275 working days per mill, and cutting effective operation down by about 25% for breakdowns, delays, etc., we arrive at, say, 210 working days per annum. The total all-out production for this period and recorded capacities of the sawmills in these States which produced black walnut in 1941 is about 478,000 M feet b.m. This figure, of course, is arbitrary in that, with assumptions 1 to 4 made valid, other sawmills would enter into more active production of walnut lumber (walnut stumpage permitting), thereby swelling the total; and secondly, the likelihood of eliminating all limitations is nil.

Stocks on Hand

The 1941 lumber canvass provided somewhat incomplete information on stocks on hand. Sawmill owners hesitate in some instances to provide the information. Small and incidental producers do not build up stocks. Rather, from their very marginal position, they sell their output as quickly as possible. Again, producers of many kinds of hardwoods at one mill do not state what species are included, or what proportion of their reported total stocks consists of each species. On the other hand, manufacturers who produce walnut lumber predominantly or exclusively probably hold the major stocks. To the extent that they report, the resource on hand is placed on record. (Table 5.)

Table 4. -- Black walnut lumber production in 1941, in the Corn Belt States, by States and by annual production classes

State	Production class (M bd.ft. per year)														
	1 - 49			50 - 99			100 - 499			500 & over			Total		
	Mills	Production		Mills	Production		Mills	Production		Mills	Production		Mills	Production	
	No.	M bd.ft.	Percent	No.	M bd.ft.	Percent	No.	M bd.ft.	Percent	No.	M bd.ft.	Percent	No.	M bd.ft.	Percent
Illinois	47	216	46	2	149	32	1	100	22	-	-	-	50	465	100
Indiana	200	1,391	15	6	284	23	14	2,216	59	4	5,394	3	224	9,285	100
Iowa	59	247	12	-	-	-	3	1,025	49	1	800	39	63	2,072	100
Kansas	42	90	2	2	135	3	3	947	18	2	3,902	77	49	5,074	100
Missouri	39	134	2	1	50	1	4	764	9	5	7,400	88	49	8,348	100
Nebraska	15	57	100	-	-	-	-	-	-	-	-	-	15	57	100
Ohio	209	865	27	1	65	2	2	400	13	1	1,839	58	213	3,169	100
Total	611	3,000	11	12	683	2	27	5,452	19	13	19,335	68	663	28,470	100

Table 5. -- Stocks of black walnut lumber on hand, for two dates, by States in the Corn Belt

State	Total walnut stocks on hand on -	
	Jan. 1, 1941	Dec. 31, 1941
	M. ft.b.m.	M ft.b.m.
Illinois	-	- -
Indiana	1,250	763
Iowa	-	275
Kansas	984	759
Missouri	919	448
Nebraska	-	-
Ohio	1,175	1,352
Total	4,328	3,597

Gunstock Blanks

A considerable volume of walnut logs went into gunstock blanks in 1941. This form of utilization was very active in one large plant in Ohio, several in Indiana, one or more in Iowa, several in Missouri, and in Kansas. Information from Kansas indicated that one large producer of walnut blanks was also subletting contracts for blanks to several smaller producers. Gunstock blanks were included as lumber and, because no segregation was made except in one or two instances, no statistics worthy of compilation could be assembled.

Allegheny Forest Experiment Station

Comp 8.22

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note 56 September 15, 1943

Preliminary Report on Lumber Production for 1942 in Iowa 1/

by L. F. Kellogg

To most people, Iowa, located in the heart of the Corn Belt, seems far removed from the whir of sawmills. Preliminary results of the census of 1942 lumber production indicate a production of 56,072,000 board feet by 823 active sawmills. These, with the 266 reported idle, total 1,089 sawmills for the State. Little of the production represents import of logs, such as occurred years ago when lumbermen rafted millions of feet of white pine logs from the Lake States down the Mississippi River to Lansing, Dubuque, Clinton, Davenport, Muscatine, and other river towns in Iowa. The importance of the present industry and its product grows under present war conditions with current restrictions on movement of lumber for local and farm uses from distant regions.

Final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, are based on a complete coverage of the industry by mail supplemented by a field canvass of delinquents and new mills by the Forest Service. Nineteen-forty-two is the first year that lumber production has been obtained in the entire State in this manner.

By kinds of wood, oak led (36 percent), followed by cottonwood, elm, walnut, maple and basswood.(table 1). Softwoods account for only 0.7 percent of the total and that came almost entirely from planted windbreaks and shelterbelts. The relatively important place of the very small farmer-owned and custom mill which produces less than 50 M board feet per year is noteworthy. A little over 16 percent of the State's 1942 production originated at mills of this character.

Table 1. -- Estimated lumber production in Iowa by kind of wood and size class of mill, in 1942

Kind of wood	Quantity produced annually by mills producing: 49M & less	50M or more	Total	Proportion
	M ft. b.m.	M ft. b.m.	M ft. b.m.	Percent
Softwoods 1/				
Cedar	2	7	9	-
Fir (balsam)	17	36	53	0.1
Larch	2	73	75	0.1

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the result of surveys made by the Forest Service, U. S. Depa rtment of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce and the Statistics Division, War Production Board. In Iowa the State Forester and the Extension Service, Iowa State College gave active support and assistance to the work.

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Table 1 (Cont'd)

Kind of wood	Quantity produced annually by mills producing: 49M & less	Quantity produced annually by mills producing: 50M or more	Total	Proportion
	M ft. b.m.	M ft. b.m.	M ft. b.m.	Percent
Softwoods (cont'd)				
Pine (white)	71	73	144	0.3
Pine (yellow)	19	33	52	0.1
Spruce	10	48	58	0.1
Total Softwoods	121	270	391	0.7
Hardwoods				
Ash	184	631	815	1.4
Basswood	451	2,720	3,171	5.7
Birch (river)	55	287	342	0.6
Cottonwood	2,375	9,269	11,644	20.8
Elm	1,891	7,058	8,949	16.0
Hickory	68	220	288	0.5
Maple	695	3,618	4,313	7.7
Oak	2,977	17,143	20,120	35.8
Sycamore	54	266	320	0.6
Walnut	108	5,368	5,476	9.8
Other:				
Black cherry	7	7	14	-
Box elder	4	2	6	-
Butternut	-	41	41	0.1
Hackberry	19	22	41	0.1
H. locust	-	5	5	-
Willow	47	89	136	0.2
Total Hardwoods	8,935	46,746	55,681	99.3
Total all woods	9,056	47,016	56,072	100.0
Percent	16.2	83.8	100.0	-

1/ Softwood lumber sawed predominantly from logs cut in plantations established during the 1860's to 1890's. The "larch" is European larch and the "spruce" is Norway spruce.

Table 2 gives the production and number of mills by counties.

Table 2. -- Estimated lumber production in Iowa and number of sawmills by size class of mill, in 1942 1/

County or counties	Production class					Total mills	Active mills	
	Idle mills	49 M per year or less		50 M per year or more			Production	Mills
		Mills	Production	Mills	Production			
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Adair & Union	1	3	20	3	239	7	259	6
Adams, Montgomery & Pottawattamie	10	8	66	3	1,056	21	1,122	11
Allamakee	7	15	288	15	3,315	37	3,603	30
Appanoose	4	13	275	6	470	23	745	19
Audubon, Harrison & Shelby	4	7	174	3	679	14	853	10
Benton	1	5	82	3	203	9	285	8
Blackhawk	1	4	47	5	681	10	728	9
Boone, Marshall & Story	6	7	118	4	848	17	966	11
Bremer	-	10	174	3	635	13	809	13
Buchanan & Delaware	1	15	298	6	948	22	1,246	21
Buena Vista, Calhoun, Cherokee, Ida, Pocahontas, Sac & Woodbury	14	7	121	3	998	24	1,119	10
Butler, Cerro Gordo, Franklin & Grundy	4	7	164	5	404	16	568	12
Carroll	-	3	57	-	-	3	57	3
Cass	2	-	-	-	-	2	-	-
Cedar	3	6	54	5	1,035	14	1,039	11
Chickasaw & Winneshiek	8	25	379	4	350	37	729	29
Clarke	1	6	56	3	110	10	166	9
Clay, Dickinson, Emmet, O'Brien & Osceola	2	6	119	3	514	11	633	9
Clayton	12	30	540	15	4,836	57	5,376	45
Clinton & Jones	5	7	82	6	946	18	1,028	13
Crawford	1	4	43	-	-	5	43	4
Dallas & Polk	8	10	206	3	949	21	1,155	13
Davis	6	11	221	6	488	23	709	17
Decatur, Lucas & Wayne	12	19	337	5	372	36	709	24
Des Moines	6	8	82	4	1,778	18	1,860	12
Dubuque	5	13	115	13	6,203	31	6,318	26
Fayette	3	14	203	7	831	24	1,034	21
Floyd	5	5	97	-	-	10	97	5
Fremont	1	7	72	3	381	11	453	10
Greene	2	-	-	3	217	5	217	3
Guthrie	2	3	9	3	320	8	329	6
Hamilton, Hancock, Kossuth & Wright	5	6	47	3	498	14	545	9
Hardin	3	9	60	4	396	16	456	13
Henry & Louisa	10	22	358	6	528	38	886	28

Table 2 (Cont'd)

County or counties	Production class					Total mills	Active mills	
	Idle mills	49 M per year or less		50 M per year or more				
		Mills	Production	Mills	Production		Production	Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Howard & Mitchell	5	10	186	3	394	18	580	13
Humboldt	-	3	39	-	-	3	39	3
Iowa	2	10	172	7	859	19	1,031	17
Jackson	3	17	328	10	1,408	30	1,736	27
Jasper	2	6	140	3	403	11	543	9
Jefferson & Keokuk	6	18	330	5	317	29	647	23
Johnson	7	17	355	6	770	30	1,125	23
Lee	6	3	65	7	602	16	667	10
Linn	1	12	141	11	2,528	24	2,669	23
Lyon	(no sawmills found)							
Madison & Warren	8	15	184	3	200	26	384	28
Mahaska	3	11	226	5	265	19	491	16
Marion	5	14	281	5	912	24	1,193	19
Mills	7	3	30	-	-	10	30	3
Monona	6	6	120	-	-	12	120	6
Monroe	1	4	71	3	256	8	327	7
Muscatine	6	5	66	5	2,084	16	2,150	10
Page	-	4	101	-	-	4	101	4
Palo Alto	1	3	33	-	-	4	33	3
Plymouth	3	5	38	-	-	8	38	5
Poweshiek & Tama	12	15	258	6	1,094	33	1,352	21
Ringgold & Taylor	5	9	106	3	231	17	337	12
Scott	5	7	164	-	-	12	164	7
Sioux	(no sawmills found)							
Van Buren	2	7	123	7	1,518	16	1,641	14
Wapello	3	7	137	3	606	13	743	10
Washington	7	15	254	10	742	32	996	25
Webster	3	12	111	4	261	19	372	16
Winnebago & Worth	2	6	33	3	338	11	371	9
Total	266	559	9,056	264	47,016	1,089	56,072	323

1/ Several counties have been combined to avoid disclosing data for individual establishments.

The total production provides added valuable information when it is segregated into the portions manufactured by mills of different total output. In table 3, besides the relatively large portion manufactured by small producers, the production of medium-sized operations accounted for about 50 percent of the 1942 production; and the relatively few half- to one-million-foot operations, and those producing 1 to 5 million board feet accounted for about a seventh and a fifth of Iowa's 1942 production, respectively.

Table 3. -- Number and estimated production of sawmills by production classes, in Iowa, in 1942

Annual production class (M feet b.m.)	Sawmills	Lumber production	
	Number	M feet b.m.	Percent
1 - 49	559	9,056	16.2
50 - 499	239	28,382	50.6
500 - 999	17	7,792	13.9
1000 - 4999	8	10,842	19.3
Total	823	56,072	100.0

The sawmill industry carried relatively low stocks in Iowa. Out of the 823 producing sawmills, in 1942, only 60 reported carrying stocks (table 4). The small mills had very little on hand. The 50 M to 499 M class group, comprising about 40 percent of those reporting stocks, carried only a few hundred thousand feet. Although the two larger groups reported carrying around a half million feet, it actually amounts to little in relation to current needs for remanufacture, maintenance and repair. In all, these reported totals show a decline of about 100 M during the year. Apparently Iowa's lumber moved on to the farmer, consumer, concentration yard operator, retail yard, or to wood-using industry just about as fast as the sawmills produced it.

Table 4. -- Number and estimated production of mills reporting stocks on Jan. 1 and Dec. 31, 1942, and the amount of those stocks

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand 1942	
	Mills	Production	Jan. 1	Dec. 31
	Number	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	23	596	28	43
50 - 499	25	3,470	438	224
500 - 999	6	3,759	82	352
1000 - 4999	6	6,594	475	301
Total	60	14,419	1,023	920

Allegheny Forest Experiment Station

Comp. 8.22

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note No. 57 September 15, 1943

Preliminary Report on Lumber Production for 1942 in Ohio[1/]

by L. F. Kellogg

The sawmills of Ohio produced 270,392,000 board feet of lumber in 1942. The 1942 lumber census, which has just closed, tallied 1,494 active mills and 359 idle ones, which total 1,853 for the State (table 1).

Sawmills were producing rapidly during the early part of the year in response to active war demands. With the advance of the year, the Army's drafting of labor and, in cases, owners of sawmills, together with other losses of labor, caused a falling off in production. The year ended in a month of bad weather.

The final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, will be based on a complete coverage of the industry by mail supplemented by a field canvass of delinquents by the Forest Service. Nineteen-forty-one was the first year and 1942 the second that lumber production has been obtained in Ohio in this manner.

Table 1.--Reported production of lumber, in Ohio, for 1941 and 1942

Includes output of all classes of sawmills producing 1,000 bd. ft. or more per annum

Year	Production	Mills
	M feet b.m.	Number
1941	306,323	1,649
1942	270,392	1,494

The State's production is estimated to have declined from 306.3 million feet to 270.4 million feet, a decrease of about 36 million, or 11.7 percent (basis, 1941), and the number of active mills to have declined from 1,649 in 1941 to 1,494 in 1942.

Table 2 shows Ohio's 1942 production, as reported, distributed by kinds of wood. Although sawmills produce hardwood predominantly there was about 1.1

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the results of surveys made by the Forest Service, U. S. Department of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce, and the Statistics Division, War Production Board, and with the assistance of the State Forester's staff, Wooster, Ohio (for canvass in 1941).

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percent of the total which was softwood, primarily southern yellow pines and hemlock, together with lesser amounts of three other native softwoods. Among the hardwoods, oak accounted for about 50 percent of the sawing, followed by maple (11.7 percent), beech (11.4 percent), elm (7.4 percent), yellowpoplar (4.0 percent), and a variety of other hardwoods. Table 2 also shows the amounts produced by mills sawing 49 M bd. ft. and less per year, and by mills producing 50 M bd. ft. and more per year.

Table 2.--Estimated lumber production in OHIO, by kinds of wood and size class of mill, in 1942

Kind of wood	Quantity produced per annum by mills producing: 49 M & less	50 M or more	Total	Proportion
	M feet b.m.	M feet b.m.	M feet b.m.	Percent
Softwoods				
Cedar	16	117	133	0.1
Hemlock	16	620	636	0.2
Larch	-	45	45	-
Pine, white 1/	1	264	265	0.1
Pine, yellow	134	1,679	1,813	0.7
Total softwoods	167	2,725	2,892	1.1
Hardwoods				
Ash	254	5,789	6,043	2.2
Basswood	166	3,677	3,843	1.4
Beech	1,371	29,466	30,837	11.4
Birch	14	366	380	0.1
Chestnut	338	4,535	4,873	1.8
Cottonwood	205	3,085	3,290	1.2
Elm	1,285	18,689	19,974	7.4
Gum, red	32	569	601	0.2
Hickory	362	7,803	8,165	3.0
Maple	1,414	30,291	31,705	11.7
Oak	5,228	132,079	137,307	50.8
Sycamore	301	3,360	3,661	1.4
Tupelo, black gum	78	1,791	1,869	0.7
Walnut	77	3,568	3,645	1.4
Yellowpoplar	501	10,266	10,767	4.0
Other hardwoods				
Black cherry	22	412	434	0.2
Box elder	-	1	1	-
Buckeye	-	3	3	-
Catalpa	1	-	1	-
Cucumber	2	14	16	-
Hackberry	6	8	14	-
Locust	4	38	42	-
Sassafras	-	3	3	-
Willow	1	25	26	-
Total hardwoods	11,662	255,838	267,500	98.9
Total, all woods	11,829	258,563	270,392	100.0
Percent	4.4	95.6	100.0	-

1/ Includes old planted windbreaks and farmstead trees; mostly from native relict groups and fringes.

The compiling of lumber sawed by county units is useful in delineating portions of the state where lumbering stands largest in the local economy. Table 3 presents county totals of lumber production and number of sawmills, subdivided further into three classes: idle, sawing 1 - 49 M bd. ft. per year, and sawing 50 M bd. ft. per year. To avoid disclosing data for individual establishments, adjacent counties have been combined in several cases (table 3).

Table 3.--Estimated lumber production and number of sawmills by counties and by size classes of mill in Ohio in 1942[1/]

County or counties	Idle mills	Production class: 49 M per year or less		Production class: 50 M per year or more		Total mills	Active mills	
		Mills	Production	Mills	Production		Production	Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Adams	14	15	340	26	4,752	55	5,092	41
Allen	2	4	75	5	1,441	11	1,516	9
Ashland	6	10	184	9	3,883	25	4,067	19
Ashtabula	11	9	214	32	14,381	52	14,595	41
Athens	3	3	41	17	5,415	23	5,456	20
Auglaize	-	9	236	5	1,748	14	1,984	14
Belmont	-	7	143	13	4,668	20	4,811	20
Brown	8	6	110	6	2,288	20	2,398	12
Carroll & Stark	8	12	203	28	8,952	48	9,155	40
Champaign	1	8	88	5	1,992	14	2,080	13
Clark & Montgomery	8	8	161	3	1,252	19	1,413	11
Clermont & Hamilton	8	8	103	3	410	19	513	11
Columbiana	4	11	179	19	6,294	34	6,473	30
Coshocton	3	6	165	21	6,327	30	6,492	27
Crawford	2	5	144	6	879	13	1,023	11
Cuyahoga	3	3	23	3	1,810	9	1,833	6
Darke	9	8	213	5	1,186	22	1,399	13
Defiance	1	6	60	7	954	14	1,014	13
Delaware	1	4	44	8	3,185	13	3,229	12
Erie	3	4	36	5	1,977	12	2,013	9
Fairfield	3	10	129	4	828	17	957	14
Fayette & Clinton	8	9	190	5	1,260	22	1,450	14
Franklin & Madison	5	13	247	4	2,133	22	2,380	17
Gallia	8	17	251	7	1,559	32	1,810	24
Geauga	4	8	148	15	5,389	27	5,537	23
Greene	5	5	76	4	340	14	416	9
Guernsey	8	5	117	21	6,680	34	6,797	26
Hancock & Wood	-	4	109	10	991	14	1,100	14
Hardin	6	8	152	4	1,238	18	1,390	12
Harrison	4	4	82	15	4,750	23	4,832	19
Henry	-	10	269	7	839	17	1,108	17
Highland	8	9	144	9	1,051	26	1,195	18
Hocking	12	11	246	25	7,595	48	7,841	36

Table 3 (cont'd)

County or counties	Idle mills	Production class: 49 M per year or less: Mills	Production class: 49 M per year or less: Production	Production class: 50 M per year or more: Mills	Production class: 50 M per year or more: Production	Total mills	Active mills: Production	Active mills: Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Holmes	3	6	183	33	8,753	42	8,936	39
Huron	10	10	138	6	2,371	26	2,509	16
Jackson	5	12	243	16	3,732	33	3,975	28
Jefferson	3	5	77	18	6,494	26	6,571	23
Knox	2	5	109	20	6,433	27	6,542	25
Lake	3	5	66	5	2,215	13	2,281	10
Lawrence	8	11	223	13	2,199	32	2,422	24
Licking	2	6	126	13	2,488	21	2,614	19
Logan	4	7	78	3	942	14	1,020	10
Lorain	5	9	178	8	4,533	22	4,711	17
Lucas & Fulton	4	8	187	14	3,024	26	3,211	22
Marion & Union	4	6	132	5	1,250	15	1,382	11
Medina	2	7	149	11	4,283	20	4,432	18
Meigs	3	6	134	8	1,593	17	1,527	14
Mercer	6	8	140	7	2,000	21	2,140	15
Miami	1	4	41	4	3,261	9	3,302	8
Monroe	3	6	134	11	2,567	20	2,701	17
Morgan	7	8	199	5	2,709	20	2,908	13
Morrow	2	6	95	6	1,075	14	1,170	12
Muskingum	4	8	193	12	4,746	24	4,939	20
Noble	6	9	102	11	2,327	26	2,429	20
Perry	5	-	-	6	2,193	11	2,193	6
Pickaway	1	4	54	4	587	9	641	8
Pike	5	13	329	52	12,890	70	13,219	65
Portage & Mahoning	9	20	463	8	3,266	37	3,729	28
Preble	2	3	115	3	1,006	8	1,121	6
Putnam	6	7	194	6	1,131	19	1,325	13
Richland	5	16	234	13	3,140	34	3,374	29
Ross	8	17	465	23	4,297	48	4,762	40
Sandusky & Ottawa	3	7	115	5	1,969	15	2,084	12
Scioto	12	22	521	37	6,811	71	7,332	59
Seneca	4	13	130	8	1,917	25	2,047	21
Shelby	2	4	70	4	1,432	10	1,502	8
Summit	1	5	118	3	1,142	9	1,260	8
Trumbull	5	9	201	20	11,926	34	12,127	29
Tuscarawas	7	3	35	22	7,899	32	7,934	25
Van Wert & Paulding	9	7	116	5	1,474	21	1,590	12
Vinton	3	3	74	20	7,253	26	7,327	23
Warren & Butler	9	12	241	3	624	24	865	15
Washington	6	11	162	33	5,716	50	5,878	44
Wayne	1	11	216	13	2,178	25	2,394	24
Williams	2	6	75	6	914	14	989	12
Wyandot	1	3	52	8	1,556	12	1,608	1
Total	359	607	11,829	887	258,563	1,853	270,392	1,494

1/ Several counties have been combined to avoid disclosing data for individual establishments.

Some 95.6 percent of Ohio's 1942 lumber output came from sawmills producing 50 M bd. ft. per year or more. Subdivision of this amount by production classes provides additional information on the structure of the industry. In table 4, analysis of this division shows that almost half of the lumber sawed (48.1 percent) originated in mills which produced from 50 to 499 M bd.ft. during the year. This group also contained the largest number of mills. About 29 percent was sawed at mills producing between a half million and a million bd. ft. per annum; and about 18 percent by the small group of mills sawing over a million bd. ft. per year. By contrast, the 607 small mills, producing 1 - 49 M bd. ft. per year, accounted for only 4.4 percent of the 1942 lumber production (table 4).

Table 4.--Number and estimated production of sawmills by production classes, in Ohio, in 1942

Production class (M feet b.m.)	Sawmills	Lumber production	
	Number	M feet b.m.	Percent
1 - 49	607	11,829	4.4
50 - 499	710	130,174	48.1
500 - 999	130	78,873	29.2
1000 - 4999	47	49,516	18.3
Total	1,494	270,392	100.0

Many sawmills in Ohio sell their product to secondary wood-using industries, to concentration yards, to brokers, to ultimate users, or to farmers directly from the saw. Only a portion of Ohio's sawmills carry stocks of lumber. In the canvass for 1942, 331 mills reported them, the bulk being carried by the mills in the 50 - 499 M and 500-999 M bd. ft. per annum classes. For the State as a whole, reported stocks on hand at the sawmills shrunk from about 15 million bd. ft. on January 1, to about 9 million bd. ft. at the end of the year (table 5).

Table 5.--Number and estimated production of mills reporting stocks on January 1 and on December 31, 1942, and the amount of those stocks, by production classes, in Ohio

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	Number	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	75 1/	1,590	576	371
50 - 499	190	41,353	7,421	3,545
500 - 999	53	36,689	4,459	2,314
1000 - 4999	13	16,551	2,590	2,748
Total	331	96,183	15,046	8,978

1/ Includes 4 idle mill operators who reported stocks on hand.

Allegheny Forest Experiment Station

Comp. 8, 2 v

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus 1, Ohio

Technical Note No. 58 September 15, 1943

Preliminary Report on Lumber Production for 1942 in Indiana 1/

by L. F. Kellogg

In 1942, the lumber industry in Indiana produced 169,349,000 bd. ft. of lumber. This was produced by 842 active sawmills which, with 175 idle mills comprise the 1,017 mills of this State. The first six months of the year witnessed great activity, with many mills producing more than during a comparable period in 1941, or planning to produce more than during any recent year. Markets were highly favorable, under the early stimulation of war conditions. The advance of the year, however, brought loss of labor and of small mill owners through the draft for war duty, and loss of labor to higher-paid war industries, so that many producers fell short of their intended production; some struggled along with partial crews; and others closed small mills for the duration. Furthermore, restrictions proved unfavorable to production, and the necessity of changing from shrinking civilian markets to war markets took time, and tended to reduce production. To some small local custom mills, the shrinkage in stocks and reduction of softwood supplies from the South and far West proved a boom factor in stimulating demand for local hardwoods.

Final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, will be based on a complete coverage of the industry by mail supplemented by a field canvass of delinquents by the Forest Service. 1941 was the first year, and 1942 the second, that lumber production has been obtained in the entire State in this manner.

The complete lumber census for 1942 and that for 1941 are highly useful at this time to show closely the impact of war on Indiana's lumber industry. The canvass in 1941, by the Forest Service, U. S. Department of Agriculture, and the Bureau of the Census, Department of Commerce, working cooperatively, and with the Department of Forestry, Purdue University, perhaps showed a normal production for those times. By comparison, the 1942 lumber census, also completely covering the industry in the State, demonstrates the initial effect of this war (table 1) resulting in a lowered production for 1942 as compared with 1941.

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the results of surveys made by the Forest Service, U. S. Department of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce, and the Statistics Division, War Production Board, and with the assistance of the Department of Forestry, Purdue University, Lafayette, Ind. (for canvass in 1941).

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Table 1.--Reported production of lumber, in Indiana, for 1941 and 1942

Includes production of all classes of sawmills producing 1,000 bd. ft. or more per annum

Year	Production	Active mills
	M bd. ft.	Number
1941	202,312	910
1942	169,349	842

The State's production is estimated to have declined from about 202 million board feet in 1941 to about 169 million board feet in 1942, a decrease of 16.3 percent (basis, 1941), and the number of active mills declined from 910 in 1941 to 842 in 1942.

In kinds of wood, oak led in 1942 (47.0 percent), followed by beech (11.8 percent), maple (10.3 percent), and elm (5.2 percent), and other hardwoods (table 2). Softwoods made up only 0.2 percent of the total and that consisted of equal amounts of red cedar and Virginia pine, in the southern part of the State, and lesser quantities of cypress, and planted white pine and Norway spruce.

The compiling of county production, by the two mill size classes of 49 M and less and 50 M and over, provides an added insight on Indiana's lumber industry (table 3). To avoid disclosing data for individual establishments, the productions of some counties have been combined. The table serves to show the localities where lumber production is most prominent and reaches greatest importance in the State. There are definite localities where the industry occupies an important position in the economic life of the people.

Table 2.--Estimated lumber production in INDIANA, by kind of wood and size class of mill, in 1942

Kind of wood	Quantity produced annually by mills producing: 49 M & less	50 M or more	Total	Proportion
	M ft. b.m.	M ft. b.m.	M ft.b.m.	Percent
Softwoods				
Cedar	8	106	114	0.1
Cypress	24	5	29	-
Pine, white 1/	3	22	25	-
Pine, yellow	42	72	114	0.1
Spruce 2/	-	5	5	-
Total Softwoods	77	210	287	0.2
Hardwoods				
Ash	141	4,340	4,481	2.7
Basswood	85	2,283	2,368	1.4
Beech	825	19,194	20,019	11.8
Birch (River)	8	213	221	0.1
Chestnut	41	191	232	0.1
Cottonwood	270	5,375	5,645	3.3
Elm	577	8,182	8,759	5.2
Gum, red	79	4,223	4,302	2.5
Hickories	217	5,522	5,739	3.4
Maples	489	16,953	17,442	10.3
Oak	3,546	76,074	79,620	47.0
Sycamore	352	4,443	4,795	2.8
Tupelo, black gum	50	637	687	0.4
Walnut	126	6,101	6,227	3.7
Yellowpoplar	222	7,470	7,692	4.6
Other hardwoods				
Black cherry	4	456	460	0.3
Butternut	-	11	11	-
Cucumber	-	10	10	-
Hackberry	3	173	176	0.1
Honey locust	-	23	23	-
Kentucky coffeetree	-	4	4	-
Mahogany	-	106	106	0.1
Other tropic hdwds	-	17	17	-
Pecan	-	8	8	-
Sassafras	-	9	9	-
Willow	2	7	9	-
Total hardwoods	7,037	162,025	169,062	99.8
Total all woods	7,114	162,235	169,349	100.0
Percent	4.2	95.8	100.0	-

1/ Mostly planted trees and windbreaks.
2/ Planted Norway spruce; none native.

Table 3.--Estimated lumber production and number of sawmills, by counties and by size classes, in INDIANA, in 1942 1/

County	Production Class					Total Mills	Active Mills	
	Idle Mills	49M per year or less		50M per year or more			Total Production	Mills
		Mills	Production	Mills	Production			
	No.	No.	M ft.b.m.	No.	M ft.b.m.	No.	M ft.b.m.	No.
Adams	3	7	214	5	961	15	1,175	12
Allen	5	14	215	5	1,364	24	1,579	19
Bartholomew	3	6	116	8	2,975	17	3,091	14
Boone	-	-	-	4	698	4	698	4
Brown	1	4	72	6	708	11	780	10
Carroll, Clinton & White	6	10	162	5	2,215	21	2,377	15
Cass	4	5	95	7	1,819	16	1,914	12
Clay	3	5	103	4	760	12	863	9
Crawford	1	4	88	6	1,647	11	1,735	10
Daviess	5	15	367	5	823	25	1,190	20
Dearborn, Ohio, & Switzerland	6	10	148	9	4,539	25	4,687	19
Decatur & Jennings	3	3	70	12	1,720	18	1,790	15
Delaware	-	-	-	4	545	4	545	4
Dubois	5	7	177	27	10,321	39	10,498	34
Elkhart	2	5	92	10	4,758	17	4,850	15
Floyd & Clark	7	6	133	13	6,638	26	6,771	19
Franklin, Fayette & Union	3	12	256	15	3,977	30	4,233	27
Fulton	1	3	54	5	1,465	9	1,519	8
Gibson	5	3	49	6	577	14	626	9
Grant	1	4	89	-	-	5	89	4
Greene	6	10	243	13	2,640	29	2,883	23
Harrison	-	7	88	10	3,433	17	3,521	17
Henry & Hancock	-	4	98	3	349	7	447	7
Howard, Miami, & Tipton	1	4	38	10	1,807	15	1,845	14
Huntington	5	3	51	5	932	13	983	8
Jackson	4	9	232	17	7,994	30	8,226	26
Jasper, Benton, & Newton	6	11	116	3	430	20	546	14
Jay & Blackford	1	4	42	3	995	8	1,037	7
Johnson & Shelby	-	6	110	4	3,668	10	3,778	10
Knox	2	8	152	9	2,942	19	3,094	17
Kosciusko	1	7	133	7	1,983	15	2,116	14
Lagrange	2	4	78	4	468	10	546	8
Lake	-	4	112	-	-	4	112	4
LaPorte	2	6	105	7	2,166	15	2,271	13
Lawrence, Orange, & Pike	6	4	88	27	8,623	37	8,711	31
Madison & Hamilton	1	4	107	4	510	9	617	8

Table 3 (cont'd)

County	Idle Mills	Production Class: 49M per year or less		Production Class: 50M per year or more		Total Mills	Active Mills: Total Production	Active Mills: Mills
	No.	No.	M ft.b.m.	No.	M ft.b.m.	No.	M ft.b.m.	No.
Marion & Hendricks	3	5	67	3	772	11	839	8
Marshall	4	3	92	4	3,035	11	3,127	7
Martin	1	5	116	8	1,549	14	1,665	13
Monroe	3	5	131	7	1,953	15	2,084	12
Montgomery	-	3	118	4	729	7	847	7
Morgan	-	4	43	9	7,102	13	7,145	13
Noble	3	3	41	9	3,789	15	3,830	12
Owen	6	6	147	13	3,612	25	3,759	19
Parke	2	6	115	8	3,141	16	3,256	14
Perry	1	4	146	11	1,893	16	2,039	15
Porter & Starke	2	3	73	9	1,508	14	1,581	12
Posey	2	4	72	9	1,005	15	1,077	13
Pulaski	-	7	166	5	753	12	919	12
Putnam	2	6	109	4	2,881	12	2,990	10
Ripley	2	11	253	13	4,696	26	4,949	24
Rush	1	-	-	4	2,731	5	2,731	4
St. Joseph	2	-	-	7	2,180	9	2,180	7
Scott & Jefferson	6	7	170	13	2,957	26	3,127	20
Spencer	1	3	98	7	2,161	11	2,259	10
Steuben & DeKalb	4	10	123	8	1,784	22	1,907	18
Sullivan & Vigo	3	5	107	11	2,479	19	2,586	16
Tippecanoe	2	4	72	3	193	9	265	7
Vanderburg	1	-	-	4	8,409	5	8,409	4
Warren, Fountain & Vermilion	11	6	60	8	927	25	987	14
Warrick	2	3	108	5	612	10	720	8
Washington	4	3	71	5	2,894	12	2,965	8
Wayne & Randolph	2	3	55	6	1,560	11	1,615	9
Wells	1	6	118	3	800	10	918	9
Whitley & Wabash	3	4	150	13	6,680	20	6,830	17
Total	175	347	7,114	495	162,235	1,017	169,349	842

1/ Several counties have been combined to avoid disclosing data for individual establishments.

A further analysis of the total production of sawmills whose output reached 50 M and over lends added detail. Mills sawing 50 to 499 M board feet annually produced about 35 percent of the State's native lumber and contained a larger number of mills than any other production class. Those producing over a million board feet per annum numbered only 50, but produced about 43 percent of the State's output. By contrast, mills producing 49 M bd. ft. or less sawed only 4.2 percent of the State's production (table 4).

Table 4.--Number and estimated production of sawmills by production classes, in INDIANA, in 1942

Production class (M feet b.m.)	Sawmills	Lumber production	
	Number	M feet b.m.	Percent
1 - 49	347	7,114	4.2
50 - 499	399	60,016	35.4
500 - 999	46	29,119	17.2
1000 - 4999	50	73,100	43.2
Total	842	169,349	100.0

For 1942, 181 sawmills reported carrying stocks. The data illustrate very well the inroads made by war demands on the regular stocks of lumber ordinarily held by primary lumber producers. The year began with about 27.7 million board feet on hand, but ended with about half that amount, only 14.2 million feet. Indeed, at the end of the year the demand was such that lumber moved easily without air drying, the remanufacturer kiln-drying it or else, in the case of boat stock, using it green (table 5). Additional shrinkage of stocks on hand may be expected.

Table 5.--Number and estimated production of sawmills reporting stocks of lumber on January 1, and on December 31, 1942, and the amount of those stocks, by production classes, in INDIANA

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	No.	M feet b.m.	M feet b.m.	
1 - 49	31 1/	591	397	24
50 - 499	92	19,515	3,380	1,490
500 - 999	25	17,118	3,532	3,270
1000 - 4999	33	60,253	20,383	9,457
Total	181	97,477	27,692	14,241

1/ Includes 7 sawmills, idle during 1942, who reported stocks on January 1, but none on December 31, 1942.

5.0

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

INTERMOUNTAIN STATION
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No. 0.73

Technical Note 59 September 15, 1943

Preliminary Report on Lumber Production for 1942 in Missouri 1/

by L. F. Kellogg
Silviculturist

During 1942, 2,084 active sawmills in Missouri produced 275,038,000 board feet of lumber. In addition, some 378 idle mills brought the total number in the State to 2,462. Early in the year mills were producing rapidly; but by midyear loss of labor to other industries and to the armed forces was telling and production lessened materially during the last six months.

Final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, are based on the complete coverage of the industry by mail supplemented by a Forest Service survey to get information from nonreporting mills and from those not previously on record. Nineteen-forty-two is the first year that lumber production has been obtained in the entire State in this manner.

The lumber production in Missouri is predominantly hardwood (88.9 percent) but softwoods comprise some 30.6 million feet (11.1 percent) and consist mostly of shortleaf pine, a little cypress and very minor amounts of cedar and other kinds (table 1). Among the hardwoods, oak lead with about 60 percent of the total volume. Cottonwood come next (6.4 percent), followed by sycamore (6.2 percent), elm (4.2 percent), walnut (3.3 percent) and lesser amounts of others. Small mills operated only a few days a year, farmer-owned mills and even some local custom mills sawing less than 50 M board feet per year produced 7.2 percent of the year's total, some 19.9 million board feet.

Table 1. -- Estimated lumber production in MISSOURI, by kinds of wood and size class of mill, in 1942

Kind of wood	Quantity produced per annum by mills sawing: 49 M & less per annum	50 M & over per annum	Total	Proportion
	M feet b.m.	M feet b.m.	M feet b.m.	Percent
Softwoods				
Cedar	81	748	829	0.3
Cypress	175	3,031	3,206	1.2
Fir (Douglas?)	-	3	3	-
Pine, white	-	16	16	-
Pine, yellow	476	26,089	26,565	9.6
Total softwoods	732	29,887	30,619	11.1
Hardwoods				
Ash	134	973	1,107	0.4
Basswood	36	85	121	-
Beech	2	857	859	0.3

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the result of surveys made by the Forest Service, U. S. Dept. of Agriculture, in cooperation with the Bureau of the Census, U. S. Dept. of Commerce and the Statistics Division, War Production Board. In Missouri the State Forester gave active support and assistance to the work.

Table 1 (Cont'd)

Kind of wood	Quantity produced per annum by mills sawing: 49 M & less per annum	Quantity produced per annum by mills sawing: 50 M & over per annum	Total	Proportion
	M feet b.m.	M feet b.m.	M feet b.m.	Percent
Birch, river	65	500	565	0.2
Cottonwood	1,923	15,667	17,590	6.4
Elm	2,064	9,595	11,659	4.2
Gum, red	115	6,448	6,563	2.4
Hickory	387	5,027	5,414	2.0
Maple	549	4,369	4,918	1.8
Oak	12,377	148,249 ~~151,587~~	160,626 ~~163,964~~	~~59.7~~ 58.5
Sycamore	1,101	15,848	16,949	6.2
Tupelo, black gum	159	4,263	4,407	1.6
Walnut	246	12,037 ~~8,699~~	12,283 ~~8,945~~	~~3.3~~ 4.5
Yellowpoplar	4	457	461	0.2
Other hardwoods				
Black cherry	-	16	16	-
Box elder	-	70	70	-
Hackberry	29	328	357	0.1
Kentucky coffeetree	1	-	1	-
Locust	-	85	85	-
Mahogany	-	1	1	-
Mulberry	-	2	2	-
Pecan	2	27	29	-
Willow	20	316	336	0.1
Total hardwoods	19,194	225,225	244,419	88.9
Total all woods	19,926	255,112	275,038	100.0
Percent	7.2	92.8	100.0	

Compilation of production on the basis of counties brings out the importance of the forest and its industries by localities (table 2). Annual production varied from about 100,000 board feet, or less, per county to over 12,000,000 board feet per county. The eastern half of the Ozarks is the largest lumber-producing portion of the State. Over much of the remainder of the State, total production amounted to 2.5 million feet per county or less during 1942.

Table 2. -- Estimated lumber production in Missouri and number of sawmills by size class of mill, in 1942 1/

County or counties	Production class: Idle mills	49 M or less per year: Mills	49 M or less per year: Production	50 M or more per year: Mills	50 M or more per year: Production	Total mills	Active mills: Total production	Active mills: Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Adair	4	13	299	9	875	26	1,174	22
Andrew & Holt	11	21	588	6	324	38	912	27
Atchison	2	6	140	3	268	11	408	9
Barry	2	5	148	11	1,922	18	2,070	16
Bates & Cass	7	14	214	5	433	26	647	19
Benton	3	11	218	10	2,061	24	2,279	21
Bollinger	2	10	188	35	9,562	47	9,750	45
Boone	4	8	120	5	520	17	640	13

Table 2 (Cont'd)

County or counties	Production class					Total mills	Active mills	
	Idle mills	49 M or less per year: Mills	49 M or less per year: Production	50 M or more per year: Mills	50 M or more per year: Production		Total production	Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Buchanan	1	9	114	3	3,622	13	3,736	12
Butler	2	21	560	27	11,044	50	11,604	48
Caldwell	5	10	116	3	185	18	301	13
Callaway	10	11	170	6	385	27	555	17
Camden	7	9	160	12	1,049	28	1,209	21
Cape Girardeau	-	14	327	18	10,017	32	10,344	32
Carroll & Ray	8	30	587	3	480	41	1,067	33
Carter	2	8	230	19	4,667	29	4,897	27
Cedar	5	8	174	9	801	22	975	17
Chariton	5	19	313	4	539	28	852	23
Christian	1	4	110	14	1,561	19	1,671	18
Clark & Scotland	6	15	226	3	400	24	626	18
Clay & Clinton	5	17	273	5	520	27	793	22
Cole	3	10	202	7	1,003	20	1,205	17
Cooper	4	16	270	5	806	25	1,076	21
Crawford	5	6	85	17	3,968	28	4,053	23
Dade	2	3	70	4	620	9	690	7
Dallas	2	3	73	13	2,100	18	2,173	16
Daviess	8	5	120	6	809	19	929	11
DeKalb	3	6	121	3	400	12	521	9
Dent	2	5	129	11	5,197	18	5,326	16
Douglas	3	9	175	30	6,505	42	6,680	39
Dunklin & Pemiscot	1	9	180	17	3,860	27	4,040	26
Franklin	8	23	476	14	2,316	45	2,792	37
Gasconade	6	20	314	8	869	34	1,183	28
Gentry & Worth	7	12	233	8	852	27	1,085	20
Greene & Lawrence	4	5	134	10	1,461	19	1,595	15
Grundy	2	11	219	3	359	16	578	14
Harrison	3	14	265	4	291	21	556	18
Henry	4	10	187	5	1,919	19	2,106	15
Hickory	3	8	155	5	310	16	465	13
Howard	1	3	75	5	1,169	7	1,244	6
Howell	1	12	265	19	6,384	32	6,649	31
Iron	3	15	351	24	5,153	42	5,504	39
Jackson	2	3	17	3	3,488	8	3,505	6
Jasper	1	4	81	7	1,588	12	1,669	11
Jefferson	2	6	54	7	1,840	15	1,894	13
Johnson	4	7	165	4	537	15	702	11
Knox	5	14	281	3	375	22	656	17
Laclede	5	13	194	14	2,565	32	2,759	27
Lafayette	5	8	80	7	584	20	664	15
Lewis	5	10	217	5	482	20	699	15
Lincoln	6	10	207	6	1,775	22	1,982	16
Linn	5	29	537	3	191	37	728	32
Livingston	3	11	257	9	1,270	23	1,527	20
McDonald	7	11	258	23	3,539	41	3,797	34
Macon	3	15	244	7	600	25	844	22
Madison	6	8	163	24	5,092	33	5,255	32

Table 2 (Cont'd)

County or counties	Production class					Total mills	Active mills	
	Idle mills	49 M or less per year		50 M or more per year			Total production	Mills
		Mills	Production	Mills	Production			
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Maries	-	10	220	7	693	17	913	17
Marion	7	6	87	6	2,196	19	2,283	12
Miller	5	16	241	5	655	26	896	21
Mississippi	-	3	98	10	4,835	13	4,933	13
Moniteau	2	3	55	6	918	11	973	9
Monroe	5	15	262	5	369	25	631	20
Montgomery	2	9	170	7	757	18	927	16
Morgan	2	10	140	17	2,346	29	2,486	27
New Madrid	3	5	145	7	5,583	15	5,728	12
Newton	2	5	145	8	1,106	15	1,251	13
Nodaway	4	3	41	3	322	10	363	6
Osage	5	11	295	13	2,099	29	2,394	24
Ozark	6	10	220	20	5,890	36	6,110	30
Perry	1	10	177	17	3,570	28	3,747	27
Pettis	1	5	109	3	655	9	764	8
Phelps	3	10	94	10	2,722	23	2,816	20
Platte	1	8	107	-	-	9	107	8
Polk	2	5	57	5	559	12	616	10
Pulaski	2	10	225	3	595	15	320	13
Putnam & Mercer	5	17	333	3	290	25	623	20
Ralls	11	12	236	6	1,117	29	1,353	18
Randolph, Audrain & Pike	1	7	119	5	456	13	575	12
Reynolds	10	7	201	49	12,026	66	12,227	56
Ripley	2	11	276	32	8,165	45	8,441	43
St. Charles	2	4	109	7	980	13	1,089	11
St. Clair	3	8	145	5	770	16	915	13
St. Francois	3	4	80	11	2,056	18	2,136	15
St. Genevieve	8	20	372	14	2,118	42	2,490	34
St. Louis & St. Louis (city)	-	4	105	3	2,632	7	2,737	7
Saline	4	8	139	9	1,005	21	1,144	17
Schuyler	6	4	100	3	166	13	266	7
Scott	1	4	45	6	2,777	11	2,822	10
Shannon & Oregon	3	6	109	34	15,901	43	16,010	40
Shelby	4	10	180	7	417	21	597	17
Stoddard	6	5	122	24	9,602	35	9,724	29
Stone	2	6	133	8	1,500	16	1,633	14
Sullivan	2	13	252	4	340	19	592	17
Taney	3	15	302	6	1,172	24	1,474	21
Texas	7	24	565	39	10,093	70	10,658	63
Vernon & Barton	4	7	68	8	1,305	19	1,373	15
Warren	2	4	116	4	411	10	527	8
Washington	1	7	183	32	6,596	40	6,779	39
Wayne	5	14	408	40	10,406	59	10,814	54
Webster	1	6	105	10	3,152	17	3,257	16
Wright	3	7	106	10	2,277	20	2,383	17
Total	378	1,005	12,926	1,079	255,112	2,462	275,038	2,084

1/ Several counties have been combined to avoid disclosing data for individual establishments.

Further analysis of the 255 million board feet sawed by mills producing 50 M per annum or more shows some interesting details (table 3). About half of the State's production originated in sawmills producing from 50 to 499 M board feet during the year. About 20 percent originated in mills which sawed from 500 to 999 M board feet, and 22 percent came from the largest producers, 1 million feet or more. Small mills produced the remaining 7.2 percent.

Table 3. -- Number and estimated production of sawmills by production classes, in MISSOURI, in 1942

Production class (M feet b.m.)	Sawmills	Lumber production	
	No.	M feet b.m.	Percent
1 - 49	1,005	19,926	7.2
50 - 499	958	139,881	50.9
500 - 999	85	54,024	19.6
1000 - 4999	36	61,207	22.3
Total	2,084	275,038	100.0

For such a sizeable State production, operators reported holding rather low stocks on hand. Small mills held very little. A material decline in stocks on hand was reported by only one group, producers of 50 - 499 M per annum, who reported 5.5 million on January 1 and only 3.1 million feet on December 31, 1942. The next larger producing group gained from 0.3 to 1.0 million feet, and the producers of 1.0 million or more held steady (table 4). Taken as a whole stocks were reported to have declined from 14.3 million to 12.5 million feet, at the sawmills. The balance of the State's yearly output, apparently, moved rapidly to remanufacturers, to ultimate consumers, or into regular channels of distribution.

Table 4. -- Number and estimated production of mills reporting stocks on January 1 and December 31, 1942, and the amount of those stocks

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	No.	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	28 1/	553 1/	75	111
50 - 499	102	21,684	5,526	3,106
500 - 999	21	13,622	305	1,032
1000 - 4999	18	37,320	8,443	8,309
Total	169	73,179	14,349	12,558

1/ Two mills were idle ones.

Allegheny Forest Experiment Station Comp 8.22

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note 60 October 1, 1943

Preliminary Report on Lumber Production for 1942 in Illinois[1/]

By L. F. Kellogg, Silviculturist
and H. W. Richman, Assistant Forester,
WPB Surveys, Illinois

During 1942, 1039 active sawmills in Illinois produced 100,269,000 board feet of lumber. In addition, some 283 idle sawmills brought the total number in the State to 1,322. Early in the year, mills were producing rapidly; but by midyear loss of labor to other industries and to the armed forces was telling and production lessened materially during the last six months.

Final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, are based on a complete coverage of the industry by mail supplemented by a field canvass of delinquents and new mills by the Forest Service. The year 1942 is the first for which lumber production has been obtained in the entire State in this manner.

Practically the entire production of the State was hardwood (99.8 percent); but some 201,000 board feet of softwood was produced, consisting of bald cypress (native in swamps on the State's southern borders), northern white pine, mostly from planted groves, windbreaks and shelterbelts, and lesser amounts of native red cedar and other planted conifers or softwoods (table 1). For the State as a whole, oak led with 65.1 percent of the total, followed by cottonwood (8.0 percent), elm (6.9 percent), maple (4.5 percent), sycamore (3.9 percent), and other hardwoods. Small local farm mills and custom mills sawed 10.4 percent of the total, or some 10,399,000 board feet.

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the result of surveys made by the Forest Service, U. S. Department of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce and the Statistics Division, War Production Board. In Illinois, the State Forester and the Extension Service and the Department of Forestry at the University of Illinois all gave active support and assistance to the work.

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Table 1. -- Estimated lumber production in ILLINOIS, by kinds of wood and size class of mill, in 1942

Kind of wood	Quantity produced per annum by mills sawing: 49 M & less per annum	50 M & over per annum	Total	Proportion
	M feet b.m.	M feet b.m.	M ft.b.m.	Percent
Softwoods				
Cedar	-	35	35	-
Cypress	25	35	60	0.1
Larch 1/	-	10	10	-
Pine, white 2/	16	47	63	0.1
Pine, yellow 3/	8	15	23	-
Spruce 4/	10	-	10	-
Total softwoods	59	142	201	0.2
Hardwoods				
Ash	91	951	1,042	1.0
Basswood	45	166	211	0.2
Beech	6	565	571	0.6
Birch	12	178	190	0.2
Cottonwood	534	7,464	7,998	8.0
Elm	941	5,967	6,908	6.9
Gum, red	128	2,069	2,197	2.2
Hickory	225	2,410	2,635	2.6
Maple	372	4,116	4,488	4.5
Oak	7,325	57,948	65,273	65.1
Sycamore	498	3,409	3,907	3.9
Tupelo - Black gum	22	2,245	2,267	2.3
Walnut	101	1,264	1,365	1.3
Yellow Poplar	13	374	387	0.4
Other hardwoods				
Black Cherry	-	4	4	-
Butternut	1	-	1	-
Hackberry	26	72	98	0.1
Honey locust	-	10	10	-
Pecan	-	500	500	0.5
Sassafras	-	1	1	-
Willow	-	15	15	-
Total hardwoods	10,340	89,728	100,068	99.8
Total all woods	10,399	89,870	100,269	100.0
Percent	10.4	89.6	100.0	-

1/ All planted; probably European larch.
2/ Almost all from old planted windbreaks and farmstead trees; very little native growth.
3/ Mostly from old planted windbreaks and farmstead trees; 15 M shipped in as logs from the South.
4/ Planted Norway Spruce; none native.

Compilation shows that the lumber industry reaches greatest importance in the southern half of the State, where counties show the largest totals of production. Several of the upper Mississippi River counties, and a few bordering the Illinois River likewise produced noteworthy amounts. By and large, the prairie counties show the lowest amounts of lumber and indeed three are not known to contain a single sawmill in them. Annual lumber production varied from 5,000 board feet per county to 4,490,000 board feet per county. In table 2, the production by counties or groups of counties, and by two mill classes provides detail on the producing localities and the amounts of lumber originating there.

Table 2. -- Estimated lumber production and number of sawmills by counties and by size classes of mill, in ILLINOIS, in 1942 1/

County or Counties	Production class					Total mills	Active Mills	
	Idle mills	49M or less per Yr: Mills	49M or less per Yr: Production	50M or more per Yr.: Mills	50M or more per Yr.: Production		Total Production	Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Adams	6	14	238	7	1,245	27	1,483	21
Alexander	2	5	160	3	1,931	10	2,091	8
Bond	3	10	151	4	750	17	901	14
Brown	-	6	89	4	652	10	741	10
Bureau	4	6	38	5	683	15	721	11
Calhoun	4	6	105	7	3,276	17	3,381	13
Carroll & Whiteside	1	12	218	4	950	17	1,168	16
Cass & Menard	5	14	317	4	1,034	23	1,351	18
Champion	2	4	70	-	-	6	70	4
Christian	2	3	27	4	1,393	9	1,420	7
Clark	2	9	123	3	351	14	474	12
Clay	4	6	106	11	2,301	21	2,407	17
Clinton	5	12	211	10	2,243	27	2,454	22
Coles	3	3	27	5	394	11	421	8
Crawford	4	6	100	4	368	14	468	10
De Kalb	-	-	-	-	-	-	-	-
Du Page	-	-	-	-	-	-	-	-
Edgar	4	-	-	3	692	7	692	3
Edwards & Wabash	1	4	118	6	434	11	552	10
Effingham	3	23	328	11	4,162	37	4,490	34
Fayette	3	20	348	11	1,554	34	1,902	31
Franklin	6	5	74	6	953	17	1,027	11
Fulton	8	19	232	10	1,424	37	1,656	29
Gallatin & Saline	2	3	33	6	4,125	11	4,158	9
Greene	7	6	128	7	1,422	20	1,550	13
Hamilton	7	4	55	11	2,655	22	2,710	15
Hardin & Pope	5	4	84	8	1,090	17	1,174	12
Henry	3	4	56	3	323	10	379	7
Iroquois & Ford	-	3	62	-	-	3	62	3

Table 2 (continued)

County or Counties	Idle Mills	49M or less per year: Mills	49M or less per year: Production	50M or more per year: Mills	50M or more per year: Production	Total: Mills	Active Mills: Production	Active Mills: Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Jackson	8	19	255	9	1,789	36	2,044	28
Jasper	1	6	88	5	2,795	12	2,883	11
Jefferson	6	14	301	7	1,852	27	2,153	21
Jersey	4	7	78	6	670	17	748	13
Jo Daviess & Stephenson	1	16	162	3	986	20	1,148	19
Johnson	2	4	55	4	465	10	520	8
Kane, Cook, Kendall & McHenry	2	4	53	-	-	6	53	4
Kankakee	1	-	-	-	-	1	-	-
Knox & Peoria	3	14	256	4	590	21	846	18
Lake	-	-	-	-	-	0	-	-
Lawrence	4	4	121	6	1,842	14	1,963	10
Livingston	-	-	-	-	-	-	-	-
McDonough & Hancock	8	3	40	11	2,259	22	2,299	14
McLean & De Witt	5	7	151	5	376	17	527	12
Macon & Logan	2	5	110	3	703	10	813	8
Macoupin	10	20	327	11	2,469	41	2,796	31
Madison	8	23	414	5	1,131	36	1,545	28
Marion	3	15	192	5	1,590	23	1,782	20
Marshall	1	4	29	5	380	10	409	9
Mason & Schuyler	5	5	79	6	798	16	877	11
Massoc	1	3	61	6	3,920	10	3,981	9
Mercer, Henderson & Stark	4	4	75	3	2,487	11	2,562	7
Monroe	6	14	179	11	2,067	31	2,246	25
Montgomery	4	12	197	7	933	23	1,130	19
Morgan	-	10	159	4	268	14	427	14
Moultrie & Cumberland	1	8	186	3	475	12	661	11
Ogle	1	8	101	-	-	9	101	8
Perry	13	19	232	8	2,222	40	2,454	27
Pike	2	12	315	7	802	21	1,117	19
Piatt	-	-	-	4	365	4	365	4
Pulaski	3	-	-	4	3,497	7	3,497	4
Putnam	3	4	65	-	-	7	65	4
Randolph	7	19	379	14	3,211	40	3,590	33
Richland	5	5	100	4	857	14	957	9

Table 2 (continued)

County or Counties	Production class: Idle Mills	49M or less per year: Mills	49M or less per year: Production	50M or more per year: Mills	50M or more per year: Production	Total Mills	Active Mills: Total Production	Active Mills: Mills
	No.	No.	M ft. b.m.	No.	M ft. b.m.	No.	M ft. b.m.	No.
Rock Island	2	4	74	3	644	9	718	7
St. Clair	7	21	334	16	2,891	44	3,225	37
Sangamon	5	5	80	3	311	13	391	8
Scott	1	6	70	-	-	7	70	6
Shelby	7	24	243	6	452	37	695	30
Tazewell	10	6	34	10	1,292	26	1,326	16
Union	1	9	202	7	1,345	17	1,547	16
Vermilion & Douglas	4	4	41	3	353	11	394	7
Warren	2	-	-	-	-	2	-	-
Washington	9	31	600	4	399	44	999	35
Wayne	-	6	141	5	1,083	11	1,224	11
White	6	3	58	4	934	13	992	7
Will Grundy, La Salle & Lee	3	3	15	5	1,022	11	1,037	8
Williamson	1	4	95	3	405	8	500	7
Winnebago & Boone	2	5	45	3	330	10	375	8
Woodford	3	7	109	3	205	13	314	10
Total	283	637	10,399	402	89,870	1,322	100,269	1,039

1/ Several counties have been combined to avoid disclosing data for individual establishments.

Additional analysis of the production in mills sawing 50 M board feet or more per year showed that a little over half (51.7 percent) of the State's 1942 output originated in operations producing from 50 - 499 M board feet annually. Mills producing between a half and 1 million feet a year produced almost a fifth (19.1 percent) of the State's total, and furthermore, producers of 1 million to 5 million board feet (numbering only 13 in the State) produced about the same portion (18.8 percent) of the total (table 3). Small local farm mills and custom sawmills provided the remaining 10.4 percent.

Table 3. -- Number and estimated production of sawmills by production classes, in ILLINOIS, in 1942

Production class (M feet b.m.)	Sawmills	Lumber Production	
	Number	M feet b.m.	Percent
1 - 49	637	10,399	10.4
50 - 499	361	51,815	51.7
500 - 999	28	19,208	19.1
1000 - 4999	13	18,847	18.8
Total	1,039	100,269	100.0

Stocks on hand were rather low. Producers of about 45 percent of the State total reported holding about 6.4 million board feet at the year's beginning and only 4.6 million board feet at the year's end. Stocks do not appear to have declined as much at mills sawing 50 - 499 M board feet annually as they did at the largest mills, where they declined by a third (table 4). The State's 1942 production appears to have moved rapidly into secondary manufacturers' hands, into use on the farm, or into other regular channels of concentration, resale and refabrication for war and other uses. The requirements of adjacent large urban areas and their wood-using industries also act as an important factor, in Illinois, in rapidly draining mill stocks away from the producing mills.

Table 4. -- Number and estimated production of mills reporting stocks on January 1 and on December 31, 1942, and the amount of those stocks, by production classes, in ILLINOIS

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	Number	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	29 1/	541	78	53
50 - 499	88	17,372	1,801	1,726
500 - 999	18	13,051	1,242	583
1000 - 4999	9	14,147	3,313	2,242
Total	144	45,111	6,434	4,604

1/ Includes 3 idle mills reporting stocks.

Allegheny Forest Experiment Station

Comp. 8.2

United States Department of Agriculture
Forest Service
CENTRAL STATES FOREST EXPERIMENT STATION
Columbus, Ohio

Technical Note 61 October 1, 1943

Preliminary Report on Lumber Production for 1942 in KANSAS[1/]

By L. F. Kellogg
Silviculturist

During 1942, 222 active sawmills in Kansas produced 14,649,000 board feet of lumber. In addition, some 142 idle mills brought the total number in the State to 364. Early in the year mills were active and producing rapidly; but by midyear loss of labor to other industries and to the armed forces was telling and production lessened materially, particularly in the smaller mills. A sustaining factor was the walnut industry, which, being devoted to war effort, did not suffer as much as producers of mixed hardwoods.

Final production statistics which are now being compiled by the Bureau of the Census and which will be released by that agency in due time, are based on a complete coverage of the industry by mail supplemented by a Forest Service survey to get information from nonreporting mills and from those not previously on record.

The lumber industry of Kansas occurs predominantly in the eastern half or third of the State. The number of mills per county falls off rapidly as one moves from the eastern tiers of counties westward onto the prairies and plains. Lumber production likewise is greatest along the eastern wooded stream courses and adjacent to the Ozarkian province with its extensive forest lands. An exception to this generalization occurs in the walnut lumber industry, which largely concentrates its log supplies from a considerable area at points where better manufacture can be done at permanent plants.

The lumber production of Kansas is predominantly hardwood (99.5 percent in 1942) with additional small quantities of softwoods originating in planted groves, windbreaks and shelterbelts; in salvage of piling and other log wreckage during flood time by a few operators along the Missouri River, and in use of native red cedar. The walnut trade referred to above led with 41.5 percent of the State's production; cottonwood followed (25.0 percent), then oak (15.6 percent), elm, sycamore, maple, hackberry, and lesser quantities of other woods (table 1). The small farmer-owned mills occupy an important place in the State's sawmill industry. Their combined output was 18.7 percent —

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the result of surveys made by the Forest Service, U. S. Department of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce and the Statistics Division, War Production Board.

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almost a fifth of the State's production of hardwood lumber. This product probably never enters the regular channels of trade, and moves instead directly from the sawmill to the farms where it is used for maintenance, new outbuildings and other farm needs.

Table 1. -- Estimated lumber production in KANSAS, by kinds of wood and size class of mill in 1942

Kind of wood	Quantity produced per annum by mills producing: 49 M & less	50 M or more	Total	Proportion
	M feet b.m.	M feet b.m.	M feet b.m.	Percent
Softwoods				
Cedar	7	-	7	-
Cypress 1/	-	30	30	0.2
Pine, yellow 2/	3	9	12	0.1
Fir (Douglas) 3/	2	20	22	0.2
Total softwoods	12	59	71	0.5
Hardwoods				
Ash	43	31	74	0.5
Basswood	9	15	24	0.2
Cottonwood	780	2,884	3,664	25.0
Elm	537	1,028	1,565	10.7
Hickory	22	42	64	0.4
Maple	32	152	184	1.3
Oak	898	1,386	2,284	15.6
Sycamore	218	239	457	3.1
Walnut 4/	89	5,993	6,082	41.5
Other Hardwoods				
Hackberry	95	80	175	1.2
Honey Locust	1	-	1	-
Kentucky coffeetree	-	3	3	-
Osage Orange 5/	1	-	1	-
Total hardwoods	2,725	11,853	14,578	99.5
Total all woods	2,737	11,912	14,649	100.0
Percent	18.7	81.3	100.0	-

1/ Salvage of piling captured as flood water drift on the Missouri River; not native.
2/ From trucked-in logs or from planted groves, shelterbelts, etc.; not native.
3/ Possibly from bridge timbers or salvage of piling; not native.
4/ Includes some logs from plantations, but proportion unknown.
5/ Planted hedge rows, trees, or groves.

In table 2, the State's lumber output has been compiled, by counties, and by two mill classes, to show the number of sawmills in an active and idle status and the production in each. Annual production varied from 2,000 board feet per county to 5,267,000 board feet per county.

Table 2. -- Estimated lumber production and number of sawmills by counties and by size classes of mill, in KANSAS, in 1942 1/

County or counties known to contain sawmills	Idle mills	Production class: 49 M per year or less		50 M per year or more		Total mills	Active mills	
		Mills	Production	Mills	Production		Total production	Mills
	No.	No.	M feet b.m.	No.	M feet b.m.	No.	M feet b.m.	No.
Anderson	2	6	118	-	-	8	118	6
Brown	1	6	148	-	-	7	148	6
Chase	3	4	87	-	-	7	87	4
Cherokee & Labette	9	6	130	3	410	18	540	9
Clay & Cloud	1	3	31	-	-	4	31	3
Coffey	2	4	69	-	-	6	69	4
Crawford, Bourbon & Neosho	10	19	453	3	482	32	935	22
Dickinson	2	5	27	-	-	7	27	5
Doniphan & Atchison	8	6	75	4	499	18	574	10
Edwards	1	-	-	-	-	1	-	-
Ellsworth, Decatur, Mitchell, Osborne & Republic	3	5	61	-	-	8	61	5
Franklin, Douglas & Miami	10	14	197	3	225	27	422	17
Geary, Shawnee & Wabaunsee	10	6	88	-	-	16	88	6
Greenwood, Allen & Woodson	3	8	123	3	178	14	301	11
Harvey	1	-	-	-	-	1	-	-
Jackson & Jefferson	7	7	134	3	253	17	387	10
Jewell	3	3	11	-	-	6	11	3

Table 2 (continued)

County or counties known to contain sawmills	Idle mills	Production class: 49 M per year or less: Mills	49 M per year or less: Production	50 M per year or more: Mills	50 M per year or more: Production	Total mills	Active mills: Total production	Active mills: Mills
	No.	No.	M feet b.m.	No.	M feet b.m.	No.	M feet b.m.	No.
Kingman, McPherson & Sedgwick	6	4	71	3	411	13	482	7
Linn	5	6	107	3	685	14	792	9
Marshall, Ottawa, Riley & Washington	12	11	119	4	959	27	1,078	15
Montgomery, Chatauqua & Elk	11	4	120	5	915	20	1,035	9
Morris	4	4	46	-	-	8	46	4
Nemaha	5	9	130	-	-	14	130	9
Osage & Lyon	3	8	53	3	222	14	275	11
Pottawatomie	7	6	71	3	169	16	240	9
Rawlins	1	-	-	-	-	1	-	-
Sumner, Butler & Cowley	2	7	96	4	933	13	1,029	11
Wilson	3	9	139	-	-	12	139	9
Wyandotte, Johnson & Leavenworth	7	3	33	5	5,571	15	5,604	8
Total	142	173	2,737	49	11,912	364	14,649	222

1/ Several counties have been combined to avoid disclosures of individual establishments. Out of Kansas' 105 counties, only 57 are known to contain one or more sawmills, and therefore this table contains only these counties.

Further analysis of the production by sawmills with an output of 50 M board feet per annum, or more (table 3) shows that about 40 percent of the lumber came from mills whose production was 50 to 499 M for the year. Similarly, larger mills producing 500 - 999 M and 1,000 M board feet, or over, together, produced a like amount, or about 41 percent. The importance of the numerous small farmer-owned mills in Kansas was pointed out earlier.

Table 3. -- Number and estimated production of sawmills by production classes, in KANSAS, in 1942

Production class (M feet b.m.)	Sawmills	Lumber production	
	No.	M feet b.m.	Percent
1 - 49	173	2,737	18.7
50 - 499	46	5,929	40.5
500 - 999	1	5,983 1/	40.8
1000 - 4999	2		
Total	222	14,649	100.0

1/ Combined to avoid disclosures of individual establishments.

Stocks on hand at the sawmills were reported by only 24 of the 222 active mills, about 10 percent of the industry (by number). (Table 4) However, these 24 mills represented about half of the State's production. Again, compilation shows the relation of these supplies to size of operation, that stocks increased at the few small and medium-sized mills holding lumber, but that the stocks of the largest producers declined by about a third. In the aggregate, reported stocks in Kansas held steady and totaled about the same at the beginning and end of the year.

Table 4. -- Number and estimated production of mills reporting stocks on January 1 and on December 31, 1942 and the amount of those stocks, by production classes, in KANSAS

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	No.	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	10	217	43	112
50 - 499	11	1,497	44	193
500 - 999	1	5,983 1/	759 1/	562 1/
1000 - 4999	2			
Total	24	7,697	846	867

1/ Combined to avoid disclosures of individual establishments.

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CENTRAL STATES FOREST EXPERIMENT STATION
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Technical Note 62 October 1, 1943

Preliminary report on Lumber Production for 1942 in NEBRASKA[1/]

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During 1942, 120 active sawmills in Nebraska produced 4,740,000 board feet of lumber. In addition, some 71 idle mills brought the total number in the State to 191. Early in the year some mills were producing rapidly; but by midyear, the loss of farm labor and of mill labor to other industries and to the armed forces was taking place. This resulted in slowed operation of mills and lowered the production during the latter portion of the year.

Final production statistics which are now being compiled by the Bureau of the Census, and which will be released by that agency in due time, are based on a complete coverage of the industry by mail supplemented by a Forest Service survey to get information from nonreporting mills and from those not previously on record.

Although the major portion of Nebraska's production was hardwood (97.0 percent) there also was some 143,000 board feet of softwoods, mostly the native ponderosa pine in the northwestern counties, and also small quantities of planted yellow pine, larch, and fir in the eastern prairie section. Cottonwood was outstanding in accounting for 88.2 percent of the State's production, oak followed (3.2 percent), then elm, walnut, ash, basswood and small quantities of other woods (table 1).

Table 1.--Estimated lumber production in NEBRASKA, by kinds of wood and size class of mill, in 1942

Kind of wood	Quantity produced per annum by mills producing: 49 M or less	50 M or more	Total	Proportion
	M feet b.m.	M feet b. m.	M feet b.m.	Percent
Softwoods				
Fir[1/]	1	-	1	-
Larch[2/]	3	-	3	0.1
Pine, ponderosa[3/]	74	50	124	2.6
Pine, yellow[4/]	15	-	15	0.3
Total softwoods	93	50	143	3.0
Hardwoods				
Ash	21	25	46	1.0
Basswood	16	-	16	0.3
Cottonwood	844	3,335	4,179	88.2

1/ Preliminary data subject to revision. Final production statistics will be released by the Bureau of the Census. Both preliminary and final statistics are the result of surveys made by the Forest Service, U. S. Department of Agriculture, in cooperation with the Bureau of the Census, U. S. Department of Commerce, and the Statistics Division, War Production Board.

(Over)

Table 1 (Cont'd)

Kind of wood	Quantity produced per annum by mills producing: 49 M or less	50 M or more	Total	Proportion
	M feet b.m.	M feet b.m.	M feet b.m.	Percent
Elm	104	26	130	2.7
Hickory	1	-	1	-
Maple	3	-	3	0.1
Oak	138	14	152	3.2
Sycamore	4	-	4	0.1
Walnut	50	10	60	1.3
Other hardwoods				
Hackberry	5	1	6	0.1
Total hardwoods	1,186	3,411	4,597	97.0
Total all woods	1,279	3,461	4,740	100.0

1/ Not native; must have originated in planted grove or windbreak.
2/ Not native; probably planted European larch.
3/ The native pine in western and northwestern Nebraska.
4/ Far from native pine; probably from planted groves or windbreaks.

By far the most of Nebraska's lumber was produced in the northeastern portion of the State. In this locality, the broad Missouri River, Platte River, and Elkhorn River bottoms bear stands of cottonwood and small quantities of other woods. An analysis of the State's production, by counties, and two mill classes, shows this production and the number and status of mills (table 2). Annual production varied from 1,000 board feet per county to 1,716,000 board feet per county. In frequency of sawmills, two southeastern counties led all others in the State.

Table 2.--Estimated lumber production and number of sawmills, by counties and by size classes of mill, in Nebraska, in 1942 1/

County or counties known to contain sawmills	Production class: Idle mills	49 M per year or less: Mills	49 M per year or less: Production	50 M per year or more: Mills	50 M per year or more: Production	Total mills	Active mills: Total production	Active mills: Mills
	No.	No.	M feet b.m.	No.	M feet b.m.	No.	M feet b.m.	No.
Buffalo, Franklin & Harlan	2	4	21	-	-	6	21	4
Burt & Dodge	6	3	71	5	512	14	583	8
Butler & Saunders	2	3	45	-	-	5	45	3
Cedar, Dixon & Pierce	1	6	113	3	228	10	341	9
Cuming	2	5	112	-	-	7	112	5
Dakota & Thurston	3	4	69	3	285	10	354	7
Douglas	2	4	45	-	-	6	45	4
Gage & Thayer	3	3	36	-	-	6	36	3
Hall, Howard, Furnass & Sioux	6	5	28	4	430	15	458	9
Hamilton	1	-	-	-	-	1	-	-
Jefferson	1	4	42	-	-	5	42	4
Johnson & Otoe	-	3	54	-	-	3	54	3
Kearney	1	-	-	-	-	1	-	-
Knox & Holt	3	8	83	3	1,813	14	1,896	11

Table 2 (Cont'd)

County or counties known to contain sawmills	Idle mills	Production class: 49 M per year or less		Production class: 50 M per year or more		Total mills	Active mills	
		Mills	Production	Mills	Production		Total Production	Mills
	No.	No.	M feet b.m.	No.	M feet b.m.	No.	M feet b.m.	No.
Lancaster	-	3	36	-	-	3	36	3
Madison	1	3	35	-	-	4	35	3
Nance, Cass, Merrick & Polk	5	7	55	3	193	15	248	10
Nemaha	1	3	37	-	-	4	37	3
Pawnee	7	9	129	-	-	16	129	9
Platte	3	-	-	-	-	3	-	-
Richardson	7	11	132	-	-	18	132	11
Sarpy	3	-	-	-	-	3	-	-
Seward	3	-	-	-	-	3	-	-
Sheridan & Dawes	7	5	69	-	-	12	69	5
Washington	-	3	28	-	-	3	28	3
Wayne & Staunton	-	3	39	-	-	3	39	3
Webster	1	-	-	-	-	1	-	-
Total	71	99	1,279	21	3,461	191	4,740	120

1/ Several counties have been combined to avoid disclosures of individual establishments. Out of Nebraska's 93 counties, only 45 are known to contain one or more sawmills, and therefore this table contains only these counties.

Analysis of the State's output by classes of sawmills shows that small farmer-owned and custom-owned mills produced 27.0 percent of the total; mills producing 50 - 499 M board feet per annum produced a larger portion; and mills producing between 500 and 1,000 M board feet about equalled the second group. To avoid disclosures, these last two groups have been combined, with the result that, together they accounted for 63.0 percent of the State's 1942 production (table 3).

Table 3.--Number and estimated production of sawmills by production classes, in Nebraska, in 1942

Production class (M feet b.m.)	Sawmills: Number	Lumber production: M feet b.m.	Percent
1 - 49	99	1,279	27.0
50 - 499	19	1/ (3,461	63.0
500 - 999	2	1/ (	
Total	120	4,740	100.0

1/ Combined to avoid disclosures of individual establishments.

Stocks on hand were reported by only 5 out of the 120 active sawmills; but these represented almost half of the production for 1942. Although six mills together reported a marked increase in stocks, the quantities are insignificant and the trend of no moment (table 4).

Table 4.--Number and estimated production of mills reporting stocks on Jan. 1 and on Dec. 31, 1942, and the amount of those stocks, by production classes, in Nebraska

Production class (M feet b.m.)	Mills reporting stocks on hand		Stocks on hand, 1942	
	Mills	Production	January 1	December 31
	No.	M feet b.m.	M feet b.m.	M feet b.m.
1 - 49	2 1/	2/	2	1
50 - 499	2	2/	-	92
500 - 999	2	2/	-	100
Total	6	2,006	2	193

1/ Includes 1 idle mill reporting a small stock on hand.
2/ Combined to avoid disclosures of individual establishments.